KWAME NKRUMAH UNIVERSITY OF SCIENCE & TECHNOLOGY
INSTITUTE OF RENEWABLE NATURAL RESOURCES
DEPARTMENT OF WOOD SCIENCE & TECHNOLOGY

PERFORMANCE OF BANDSAW BLADES USED IN RIP-SAWING WAWA, (*TRIPLOCHITON SCLEROXYLON*) AT A GHANAIAN SAWMILL

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WOOD TECHNOLOGY AND INDUSTRIAL MANAGEMENT

BY

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AUGUST 2002

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DECLARATION

I, hereby, declare that this dissertation is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Date.....9/9/2002.....

.....

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CERTIFICATION

We hereby certify that the preparation and presentation of this dissertation was supervised in accordance with the guidelines on supervision of dissertation laid down by the Kwame Nkrumah University of Science and Technology.

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DEDICATION

This work is dedicated to my loving wife Mrs. Joyce Mitchual and my daughters Ethel Jobson Mitchual and Joyce Jobson Mitchual.

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ABSTRACT

An optimum side clearance and kerf width of bandsaw blade is required by the wood industry for efficient lumber production from tropical hardwoods. However, little or no work has been done on the influence of kerf width and side clearance of bandsaw blade on sawing accuracy when processing tropical hardwoods. It is the object of this study to determine the accuracy of kerf width of stellite-tipped and swage-sets saw when sawing Wawa (Triplochiton Scleroxylon) at a Ghanaian sawmill. It is also the object of this study to examine the influence of kerf width and side clearance of bandsaw blades on sawing accuracy of Wawa (Triplochiton Scleroxylon).

The research work was carried out at the FABI timbers limited in Kumasi. Eight 152mm (6 inches) bandsaw blades with similar specifications were randomly sampled from a total of ten bandsaw blades for the study. A complete randomized design and Student's T-test were used to assess the significant difference between the kerf width of stellite-tipped saws and swage-set saws and the outer and inner side clearance of stellite-tipped saws respectively.

At 5% level of significance the mean kerf width of the stellite-tipped saws which was 4.20mm was found to be significantly bigger than the kerf width of the swage-set saws which was 3.06mm. The main contributing factor to thickness variation of sawn lumber was excessive kerf width of the bandsaw blades used.

A quadratic relationship between side clearance and sawing variation was established. As the side clearance increased the sawing variation decreased until an average minimum value of

0.42mm, 0.33mm and 0.59mm standard deviation within boards, standard deviation between boards and total standard deviation respectively were obtained for a mean optimal side clearance value of 0.69mm. Thereafter the sawing variation began to increase with increasing side clearance. It was also established that when the side clearance varied from 0.8319mm to 0.4336mm for stellites saws the sawing variation was generally low having an average minimum value of 0.3485mm.

A quadratic relationship was also established between the surface smoothness of sawn lumber and the standard deviation of the side clearance. It was established that the surface smoothness of the sawn lumber was good, very good or excellent when the standard deviation of the side clearance was 0.1700mm or low and was poor or very poor when the standard deviation of the side clearance was 0.2100mm or more. The thickness variation of sawn lumber was also found to increase with increasing depth of cut.

It was observed that the ratio of the wheel diameter to the saw blade thickness ranges between 1030 and 1066. Nevertheless the ratio of the tooth pitch to the tooth height, which was 2.74 on the average, was significantly less than the recommended value of 3.

Lastly, lumber thickness at the mill used for the study was found to be out of control. The mean thickness of boards produced was 42.42mm as against a nominal thickness of 41.00mm. This resulted in a loss of 3.46m^3 of lumber for every 100m^3 of lumber produced, which was a great financial loss to the company.

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ABBREVIATIONS

F.P.I.D. - Forest Products Inspection Division

I.T.T.O. - International Tropical Timber Organisation

T.U.C. - Timber Utilisation Contract

IWMS 14 - 14th International Wood Machining Seminar

FAO - Food and Agriculture Organisation

TEDD - Timber Export Development Division

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background to the Study

The role that the timber industry plays in the socio-economic development of any country need not be emphasized. According to F.P.I.B(1995) in the early 1970's timber was next to cocoa as a major foreign exchange earner in Ghana with a contribution to the Gross National Products of about 11 percent. Besides being a source of foreign exchange earning, the industry is also a major source of employment in Ghana, currently employing a labour force of over 75,000.

The above usefulness of the forest calls for its proper and efficient management. Although sustainable management of the forest has been a global outcry, its achievement is often misconstrued to be planting more trees or leaving the forest intact. In most cases careful utilization of the forest have not received the attention it deserves. There has been occasional call for addressing the wood wastage problem but the required action it deserves is not taken, resulting in indiscriminate use of wood. This is a major drawback to achieving sustainable resource development. Efficient utilization of the resource should indeed form the basis of any forestry project, be it plantation development or reservation. It is therefore,

about time that tree breeders, foresters, agroforesters, forest economists and wood scientist come together to plan any forestry venture.

In fact maximum utilization of wood primarily depends on the state of the raw material, the method of processing and ability to sell the product. In order to ensure that timber products harvested from Ghana's natural forest can be sustained into the future, the Ministry of Lands and Forestry has launched a Forestry Development Master Plan 1996-2020 (Ministry of Lands and Forestry, 1996). As part of this document an upper limit to annual harvest has been set at one million cubic meters of round logs from both forest and off-forest reserves. Aside this, other measures like increase in royalties, acquisition of Timber Utilization Contract, ban of chainsaw operation and the sale of chainsawn lumber have been put in place in order to control the rate of exploitation of the forest as well as attaining ITTO's target in the year 2000 which aim at achieving complete sustainable forest management by the year 2000. The above measures have resulted in the rising cost of round logs. This means that the survival of the timber industry will to a large extent depend on increase in the level of efficiency of production.

Throughout the wood industry there is a strong desire for the most effective utilization of logs. There is a movement from a high-volume low-value business into a low-volume high-value trade.

Low lumber recovery at the sawmills is attributed to some of the following:

i) Poor condition of the saws

ii) Inaccurate operation of the machines

iii) Lack of maintenance

iv) Poorly integrated processing sector

v) Limited product diversity

vi) Presence of obsolete machinery.

In Ghana some of the problems associated with wood processing are thickness variation of sawn lumber, wash board, tooth marks, saw breakage and excess tolerance on target size of green lumber.

1.2 Justification

The secret of successful wood bandsawing is the interplay between man, machine, tool and money (Uddeholm Strip Steel AB, 1989). Expansion in the industry these days depends on reducing waste, using more of every log and generally trying to add value to every cubic metre rather than on

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increasing volumes taken from the forest(Coleman and Amankwah,1998).

Improved lumber recovery can be viewed as that consisting of improving the quality of logs coming into the mill, reducing saw kerf, controlling excess tolerance on target thickness, optimizing sawline decisions and developing a product mix that gives maximum lumber recovery.

According to Okai (1999) the sawn lumber recovery in Ghana is about 40%. Sawdust, which comprise of about 12% of the sawmill residue also possess a considerable problem of disposal to the sawmills. A survey conducted in Ghanaian sawmills identified some technical problems such as snaking of saws, washboards, cracking of saw blades, tooth marks, sawing variations, excessive sawdust production, which seriously affects lumber recovery (Okai, 1999). The tooth marks and the sawing variations adversely affect lumber yield in that excessive planing is required in order to produce acceptable finished boards. In situations were the lumber is not planed before selling, such defect result in the down grading of the lumber hence resulting in price reduction or export claims. A visit to sawmills in Ghana also reveals that most of the time, the clearance angles of the saws being used are not within the recommended range for the processing of hardwood and softwood. If the kerf of the saw is too big more sawdust

will be produced. This then results in sawdust spillage between the sawblade and the walls of the sawn lumber, hence reducing the effective side clearance which in turn leads to the snaking of the saw (Lemaster 1986). However too small kerf also increase friction between the sawblade and the sawn surface of the lumber, resulting in the heating of the sawblade, snaking of the sawblade and subsequently producing sawing variation of the sawn lumber. The accuracy of the saw kerf as well as the state of the saw also greatly affect the quality of the sawn lumber.

Reduction of lumber size variation as well as controlling of excess tolerance on green target size of lumber can result in increase revenue of sawmills. For example an excess tolerance of 1mm on a lumber which has a green target size of 25mm will result in 4m3 loss of raw material for every 100m3 of sawn lumber. The management of a sawmill in United State of America made a concerted effort to reduce sawing variation, target sizes and to improve sawing practices, all in collaboration with the sawmill improvement programme (SIP). As a result, raw material requirements was reduced by 12%, which was equivalent to a log input savings of $1.2 million (Brindley, 1982). Lumber thickness variation also sometimes results in wide variation of moisture content within kiln dried sawn

lumber parcels which attract export claims since lumber grade requirements demand a minimal variation in the final moisture content.

The above fact sounds very pleasing and amplifies the economic importance of improving sawmilling efficiency and ensuring that the best results are achieved. It also indicates that there is the need for a concise bandsaw characteristics to be used in the sawmills in Ghana to ensure efficient lumber production. It is against this background that a research work which aims at determining the optimal conditions for sawing, need to be done. This will help to improve upon lumber production in the sawmill industry in Ghana.

1.3 Objectives

The objectives of the study are:

1) To determine the accuracy of kerf width of bandsaws

ii) To determine sawing variation of bandsaws

iii) To determine the relationship between the side clearance of bandsaws, sawing variation and surface quality of sawn lumber.

iv) To determine the relationship between the bandsaw thickness and the wheel diameter.

v) To determine the relationship between depth of cut and sawing variation of sawn lumber.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

Sawmilling is the mechanical manufacturing process in which logs are converted into rough lumber with sawdust, slabs and edgings as residues (Frimpong-Mensah and Nagoda, 1994). Sawmilling may also be regarded as the mechanization of man's earliest activities of cutting wood into sizes useful to himself (Martyr, 1973).

The first truly production method used to break down logs by rip sawing into planks was the pitsawing. In pitsawing, logs to be sawn was rolled over a pit in the ground and sawn by two men using a double handled saw. One man stood on top of the log and the other in the pit. The work was laborious and slow when compared to todays activities. Nevertheless good cutting was obtained and the surface produced was equal to and in many cases better than that produced by mechanical means (Martyr, 1973).

2.2 Types of Sawmilling

Modern sawmilling may be divided into the following classes:

i. Portable forest sawmills.

ii. Mechanical sawyer controlled sawmills

iii. Computer-controlled sawmills.

In Ghana the commonest types of sawmills in existence are mainly the modern mechanical sawmills, with a few portable forest sawmills (Frimpong-Mensah and Nagoda, 1994).

2.2.1 Portable Sawmills

The portable forest mill is transportable and may be moved forward close to the timber source as the trees are cut down. It is intended primarily to save the cost of transporting waste materials. The portable mill is entirely independent and needs no support machinery. It is designed to convert logs on the spot where they are felled into ready to use lumber. The portable sawmills vary from units that can be towed by a small truck to larger units mounted on railway cars, large semi trailers or darges (Frimpong-Mensah and Nagoda, 1994). The simplest example is the chainsaw or simple machines ranging from 20hp to 60hp.

2.2.2 Mechanical Sawyer Controlled Sawmill

The mechanical sawyer controlled sawmills can be regarded as more sophisticated forest mills set-up on a permanent site. The logs for these mills are brought to the mill by road, rail and to a decreasing extent by water (Gallant, 1958). In these mills, the conversion process depends on human decisions about how logs are to be broken down at the headrig. Here, the sawyer makes decisions regarding

the rotational position, the sawing method and the opening face. The first sawlines on each face fixes the position of succeeding cuts (Frimpong-Mensah and Nagoda, 1994).

In Ghana these mills vary in size and efficiency. In general, the larger the mill the higher the efficiency. Most of these mills both large and small are equipped with bandsaws headrigs (Gallant, 1958). They have a log yard for piling the logs brought in from the bush. They also have edgers, resaws, cross-cut machines and in some cases contain straight line edgers. In addition to these are seasoning sheds and sawdust extraction plants (Telford, 1958).

2.2.3 Computer-Controlled Sawmills

The system of sawing in these sawmills can reduce or replace sawyer decision-making and physical effort. These sawmills use log scanners to measure log diameter, length and taper. It also uses mathematical models to calculate the sawing solution that will yield the highest volume. The computer also positions the log and saws to the settings for each solution. Aided by optimizing edgers and trimmers the automated control system maximize yield from cants, flitches and untrimmed boards with a 10-20% increase in yield over the mechanically controlled mills (Pichulo , 1974).

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2.3 Sawmills Layout and Machine Selection

When considering the layout of a sawmill the entire flow of the operations should be examined. The following list can be used as a checklist for evaluating mill traffic flow. These include the flow of the logs to the mill and flow of lumber through the production, including the stacker, air drying yard, drying kilns and planer mill (Denig, 1993). The layout may be decisive for a successful mill operation and should also take into consideration the requirements for a mill to meet future demand (Frimpong-Mensah and Nagoda, 1994). In a well laid out mill, the heavy and time consuming operations such as handling and piling of logs and sawnwood are reduced to a minimum. A basic characteristic of an efficient mill layout is that machines are placed in line so that there is continuous production flow. The raw material should come in from one end and the ready products at the other end. Return transport should within the mill be reduced to a minimum.

Mill layout and machine selection go together. In selecting the equipment and machinery it may be necessary to size the basic components considering the production capabilities and the characteristics of each machine and attempt to blend them into an overall mill layout. The

following areas of operation are important in any sawmill layout:

i. Log debarking and handling in the log yard
ii. Primary breakdown with heardrigs
iii. Secondary breakdown
iv. Edging
v. Trimming
vi. Lumber sorting and stacking in a lumber yard.

2.4 Sawmill Machinery For Sawing

Generally, there are three types of saws used in the sawmills. These are the gang or frame saws, the circular saws and the bandsaws.

2.4.1 Gangsaws

The reciprocating sash gangsaw, originally used mainly in Europe has been increasingly applied in other industrialized countries (Kollmann and Cote, 1968). The main component of the frame saw is the movable frame which consist of the sash made up of several saws, the feed work, crankshaft and connecting rod. The sash reciprocates within the main frame of the saw. The connecting rod transmits the circular motion of the crankshaft to the reciprocating movement of the sash. The blades are usually 1.1m to 1.5m long and 1.2mm to 2.5mm thick. The width ranges between 12cm to 18cm(Frimpong-Mensah and Nagoda,

1994). The angular velocity of the crank has reached 400rpm but the average cutting velocity will not exceed about 6m/s (Kollmann and Cote, 1968). It is a very heavy machine, weighing five to six tons. Its major advantages are that:

i. it makes many cuts at the same time;

ii. it is capable of high dimensional accuracy;

Its disadvantages include the following:

i. it requires the sawnlogs to be sorted;

ii. it has a low feed speed;

iii. it makes relatively wide kerf, entailing a heavy chip loss (FAO, 1985).

2.4.2 The Circular Saw

Circular saws are the most useful tools for general woodworking. They are used from primary lumber production to cabinet shop. As the name implies, it consists of a circular blade or disc, mounted on a machine. The saw rotates on a spindle in the centre and is provided with two guide pins. Its direction of rotation is towards the advancing piece of wood (FAO, 1985). Circular saws are very versatile and may be used for ripping and edging, for crosscutting of round logs and lumbers, for the production of boards, planks beams etc. (Kollmann and Cote, 1968).

The major advantages of circular saws are:

i the machine is cheap in first cost and in maintenance;

ii. it takes up little space;

iii. it can readily be incorporated into larger systems - trimmers, chipper canter etc.

Some of its disadvantages are the following:

i. thicker kerfs than the other types of saws in the case of larger sizes;

ii. susceptibility to heat and to overloading;

iii. sub-standard dimensional accuracy in some kinds of ripsawing (FAO, 1985).

For a circular saw to cut correctly it is essential that;

i) it is correctly tensioned for the intended peripheral speed.

ii) the teeth describe a true concentric circle in relation to the saw spindle.

iii) the saw plate is free of any lumps or twists that will cause the rim to run out of a true plane.

iv) the setting is even and sufficient to provide clearance and allow freedom from friction between the timber and the saw;

v) the correct tooth geometry for the class of timber to be cut should be maintained (TRADA, 1973).

2.4.3 Bandsaws

The bandsaw was invented in England in 1808. It was first driven by water power (Frimpong-Mensah and Nagoda, 1994). The bandsaw consists of a continuous band of steel with teeth on one or both edges mounted on two pulleys. A straining force Po is exerted on the wheels. As a result, a stabilising force Po/2 is introduced into the band, resulting in an accurate cut. The higher the force the better the accuracy in boards and planks (Uddeholm Strip Steel AB, 1989). To prevent the blade from slipping off the pulleys during feeding the upper pulley is slightly tilted forward. Blade guides are also provided to keep the blade running through (FAO, 1985). The advantages of bandsaws over other types of machines are:

i. small kerf losses;
ii. adaptability to large log diameters and unsorted log input;
iii. capacity for high feed speed and
iv. good surface quality of the sawn timber.

There are two distinct types of bandsaw machines: the vertical and the horizontal. The vertical type has the wheel placed above each other in a vertical plane, while in the horizontal type the wheels are placed in a horizontal plane.

2.5 Bandsaw Blades

In general there are two main types of bandsaw blades. The narrow and the wide blades. The main difference between the narrow and the wide bandsaw blades lies in the thickness to width relationship. In narrow blades the thickness is approximately double that of wide blades compared to actual width. This is due to the fact that narrow blades are spring-set, which calls for a higher thickness of the tooth in order to keep the set of the tooth over the time.(Uddeholm Strip Steel AB, 1989). Bandsaws with spring-set teeth consume less power but their maintenance requires more labour. The thickness or the guage of the saw blade, which is limited by the diameter of the bandmill wheels, is measured in millimetres or the Birmingham Wire Gauge (BWG). **Table 2.1** shows the recommended sizes of bandmill wheels to bandsaw blades.

According to Williston (1988) the rule for the relationship of saw thickness to wheel diameter is that if the bandsaw blade is not thicker than 1.2mm, the diameter of the wheel should be 1000 times its thickness. For thicker and wider blades, it should be between 1,200 to 1400 times the thickness. Although there seems to be a discrepancy between the recommended sizes of bandsaws

Table 2.1 Recommended Sizes of Bandmill Wheels to Bandsaw Blades Thickness

Wheel Diameter WD(m)	Blade Width (cm)	Blade Thickness BT(mm)	Ratio WD/BT
1.52	12.70-22.86	1.473	1034
1.68	17.78-27.94	1.651	1015
1.83	20.32-30.48	1.829	1000
2.13	25.40-35.56	2.108	1000
2.44	30.48-40.64	2.413	1000
2.74	35.56-40.64	2.769	1000

Source: FAO,1985

wheel diameters and blade thicknesses in **Table 2.1** by FAO and that of Williston (1988) the FAO's further stated that the recommendations in **Table 2.1** is intended to be a guide in other to prevent fatigue cracks in bandsaws being caused by running blades too thick on the wheels concerned. However the relationship should always be a minimum of 1000 times the blade thickness to the diameter of the wheel. Wheels that are too small for the thickness of the sawblade will cause excessive bending stresses in the blade, which will lead to gullet cracks. As the bandsaw blade is bent over the wheel, compression stresses are built upon the surface of the bandsaw blade touching the wheel face, while tension stresses are built up on the

opposite surface of the bandsaw blade. When these stresses exceed the strength of the bandsaw metal, gullet cracks develop. These stresses are directly proportional to the thickness of the blade and indirectly proportional to the diameter of the wheel. Thus a bandsaw will crack if the blade is too thick or the wheel diameter is too small (Denig, 1993). Running a heavier bandsaw gauge results not only in heavier kerf but also leads to bandsaw blade failure. Strain can be increased in order to increase stability of the blade in a cut. As the strain force is increased, stress on the blade is increased, which can lead to blade failure. Failure of the bandsaw blade occurs when all the different stresses, bending, strain, etc. exceed the strength of the metal (Denig, 1993).

An uneven bandsaw blade thickness can also give rise to additional stresses making the blade unsteady (Wood News, 1993). It is preferred to use bandsaw blades of the longest length possible depending on the range of adjustment facility existing on each pulley, so that in case of breakage the blade could be rejoined and reused (Wood News, 1993).

The maximum band width is the pulley width plus tooth height plus 3-5mm (Uddeholm Strip Steel AB, 1991). Wood

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News (1993) also recommended that the maximum width of the bandsaw blade should be equal to the pulley width plus tooth height plus 5mm which is similar to that recommended by (Uddeholm Strip Steel AB, 1991). From Wood News (1993) the minimum width achieved after constant regrinding of the bandsaw blade is usually held to be 35% of the original width, as purchased.

2.5.1 Tooth Profile of the Bandsaw Blade

The parts of the saw tooth indicated in **Figure 2.2** are:

i) Pitch (d)

The pitch is the linear distance between two adjacent teeth. A large pitch i.e. lower number of teeth per inch (2.54mm) will allow high feed speeds but will give a poorer surface and will also increase the load on each individual tooth. Reduced pitch will improve cutting surface but can increase the power required during cutting (Wood News, 1993). With a particular pitch the stability of the tooth will be related to the tooth height (h). For example the suitable pitch (Swaged teeth) for a 152 mm (6 inches) bandsaw blade with depth of gullet being equal to pitch/3 are as indicated in **Table 2.2.**

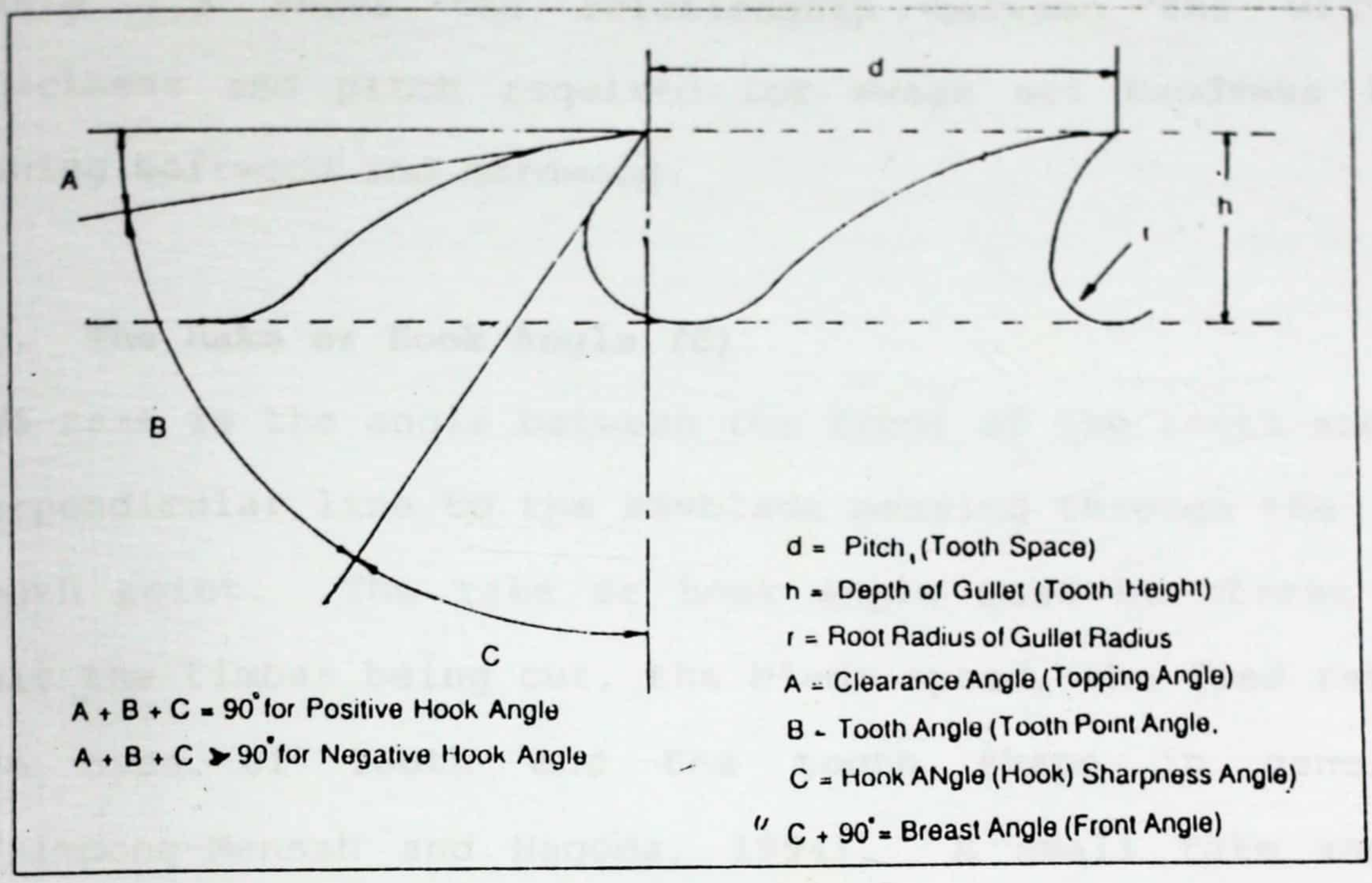


Figure: 2.1 Tooth Shape Characteristics

Source; Wood News (1993)

Table 2.2 Recommended Pitch for Sawing Softwood and Hardwood

Wood type	pitch
Softwood	45mm
Hardwood	40mm

Source: Uddeholm strip steel AB (1989).

Wood News (1993) indicated that practical application and experience has shown that when cutting low density hardwoods the depth of the gullet could be increased up to pitch/3 levels. However with denser hardwoods depth of gullet can be reduced to the d/4 and d/5 levels.

Table 2.3 shows the relationship between the width, thickness and pitch required for swage set bandsaws for sawing softwood and hardwood.

ii. The Rake or Hook Angle (C)

The rake is the angle between the front of the tooth and a perpendicular line to the sawblade passing through the tooth point. The rake or hook angle must be chosen to suit the timber being cut, the blade speed, the feed rate, the type of tooth and the tooth shape in general (Frimpong-Mensah and Nagoda, 1994). A small rake angle gives a smoother sawn surface than a large one. A blade with insufficient hook angle will not "rip" out the chips (Uddeholm Strip Steel AB 1991). If the teeth have too much hook they will be weakened and will tend to vibrate which may lead to rough sawing, tiring and tearing of knots. With swage teeth, the hook angle should be slightly wider than that of the spring-set teeth (Uddeholm Strip Steel AB, 1991). **Table 2.4** shows some recommended hook angles suitable for some feed speeds when using swage-set saws.

i) Tooth Angle (Sharpness angle)

The tooth angle determines the strength of the tooth and must be sufficiently wide. It should not usually be less than 40°. With hardwoods it may be close to 50°, with

softwoods it can possibly go down to 35° (Uddeholm Strip Steel AB, 1991).

Table 2.3 Relationship between Recommended width, Thickness and Pitch for Wide Bandsaw Blades

Bandsaw width (m)	Thickness of Blade Used(mm)	Pitch Needed(Swageset) Softwood	Hardwood
76	1.07	41	30
105	1.07	45	35
120	1.07	45	35
130	1.07	45	35
156	1.25	45	38
181	1.47	45	38
206	1.65	51	45
232	1.83	51	45
260	1.83	63	51
286	2.11	63	51
311	2.11	63	51
337	2.41	70	51
362	2.41	76	57
387	2.77	83	57
413	2.77	83	57

Source: Wood News (1993).

Table 2.4: Recommended Hook Angle for Some Feed Speeds

Feed (m/min)	Hook Angle
below 8	15°
8 - 30	20°
30 - 50	25°
50 - 60	30°

Source: Uddeholm strip Steel (1991) Wood Band Saw Blade Manual

ii) Clearance Angle (A)

This provides free space between the line of cutting and top of the tooth. The size of this angle seems not to be of great importance for the performance of the saw. It does not take part in the cutting action of the tooth. It only functions to prevent the advancing wood from pressing on the top of the tooth (Frimpong-Mensah and Nagoda, 1994). The minimum clearance should be 5° for free running bandsaw blade. However normal clearance would be around 10° (Wood News, 1993).

Wood News, (1993) recommends the tooth profile as shown in **Table 2.5** for the sawing of high, medium and low-density woods.

Table 2.5 Recommended Saw Profile for Sawing Wood

Density of Wood	Feed Speed (m/min)	Tooth Angles		
		Clearance Angle	Tooth Angle	Hook Angle
Very dense	up to 8	8°	60°	22°
High	8 - 30	10°	56°	24°
Medium	30 - 50	11°or12°	49°-52°	26°-30°
Soft	50 - 60	16°	44°	30°

Source: Wood News, (1993).

2.5.2 Setting of Bandsaws

Setting is intended to reduce friction by making the kerf wider than the thickness of the bandsaw blade (Uddeholm Strip Steel AB, 1991). Spring and Swage-set are types of saw setting. Swaging is done with a hand tool or an automatic machine. In swage setting the front edge of the tooth is spread out or swaged to a width greater than the thickness of the blade after which the sides of each tooth are pressed or moulded to the required uniform width and shape i.e. side dressing. The tops and faces of the teeth are ground on a grinding machine to obtain the required cutting edge (Uddeholm Strip Steel AB, 1989). In grinding the condition of the grinding machine itself is very important. It must be in good condition, firmly mounted on a rigid foundation and absolutely free from

vibration (Williston, 1988). Tipping is also another method of setting. Here hard material is heated and melted onto the bandsaw blade after the tooth has been swaged. With new automatic machines the material is welded onto the unswaged teeth (Uddeholm Strip Steel AB, 1991). It is necessary to side grind the teeth after tipping. Side grinding gives a very smooth tooth tip line and therefore an extremely good surface on the sawn lumber.

Each tooth on a saw must be given an equal amount of set if smooth and steady sawing is to be obtained. Unevenly set teeth place a greater strain on some teeth than others and may cause them to crack (Frimpong-Mensah and Nagoda, 1994). An unevenly kerf width causes not only badly sawn surface and greater sawing forces but also occasionally snake sawing. Therefore it is required that the sets of bandsaws are uniformly sharpened. Kohji et al (1993) obtained the results indicated in **Table 2.6** and considered it comparable to that obtained in other band saw filling shops.

If the teeth are all set more on one side than the other the saw will lead to the side with the heaviest set and breakage will result. The amount of set required varies with the character and moisture content of the timber to

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Table 2.6. The Kerf Width of the Bandsaws (mm)

Saw No.	1		2		3	
	Mean	SD	Mean	SD	Mean	SD
S_1-Saw	2.11	0.0195	2.14	0.0192	2.04	0.0164
S_2-Saw	2.13	0.0101	2.11	0.0109	2.04	0.0182

LEGEND: SD- Standard Deviation

S_1-Saw -Stellite No.1 Manually Tipped Saw

S_2-Saw -Stellite No.12 Automatically Tipped Saw

Source: Kohji et al, Japan Wood Research Society Vol 39 No.11 (1993).

be cut and with the thickness of the saw blade (Frimpong-Mensah and Nagoda, 1994). A simple rule for the required kerf of a bandsaw blade is to multiply the blade thickness by two (Denig, 1993, Wood News 1993). Also according to Denig (1993) for hardwoods that have little spring back of the wood when cutting, a side clearance of 0.306mm-0.357mm will do. For softwoods with more spring back a side clearance of 0.5mm to 0.6mm will do. From Uddeholm Strip Steel AB (1989) the following specifications as indicated in **Table 2.7** are recommended for the Sawing of Lumber.

However in practice, the side clearance is a compromise between the rule of thumb and the recommended side

Table 2.7: Amount of Swage for Different Types of Wood

Types of Wood	Projection of Swage on each side(mm)
Hardwoods	0.30-0.35
Semi-hard and frozen woods	0.40-0.45
Softwoods	0.50-0.60

Source: Uddeholm Strip Steel AB (1989), Wood Bandsaw Blade Manual.

clearance for different species. The new development of preshaped hard tips in tipping machines will help to reduce grinding time. Blades tipped by this method only require around 0.5mm grinding of each side. Blades tipped using other methods including manual tipping require up to 1.2mm grinding of each side (Uddeholm Strip Steel AB, 1991). The tipping of saw blades becomes advantageous when sawing hard and abrasive woods like Mahogany (*Khaya ivorensis*), Odum (*Milicia excelsa*), Asanfena (*Aningeria robusta*).

2.6 Sawing Accuracy

Sawing accuracy is evaluated as a statistical quantity and expressed as the standard deviation of the board thickness or width (World Wood, 1975). According to Sagoe and Helem (1998) if the standard deviation *within* the board is higher than *between* the boards, the reason for the sawing

variation is most probably to be found in the sawblade. However if the standard deviation *between* the boards is higher than that *within* the boards then the reason for the sawing variation is most probably to be found in the technical standard of the equipment or simply some loose bolts and nuts. Sawing accuracy is dependent not only on the type of machine but also upon the manner in which it is operated and upon the care and maintenance given it. Good sawing accuracy results in high efficiency in the production process, as it tends to minimize waste (Frimpong-Mensah and Nagoda, 1994). The major factors that affect sawing accuracy are:

i) Conditions of the Sawblade

ii) Feed speed, and

iii) Operational error

2.6.1 Conditions of the Saw

The main saw conditions that influence sawing accuracy include faulty condition of saw, such as the technique of setting and sharpening of teeth (Telford, 1958; Kohji et al, 1993). Factors other than the hardware of a bandsaw blade that affect its stability are: blade thickness, blade strain, blade width, distance between the guides and feeding force (Denig, 1993). Uneven filling result in uneven sharpness of the saw teeth. At the same time it produces unequal side clearance for the individual teeth.

This result in the heels of some of the teeth rubbing against the sawn surface and cause a greater stress on some of the teeth. The excessively filed tooth will have excessive clearance angles and small sharpness angles, which give sharp but weak points that vibrate in the cut and possibly break off during cutting. Uneven filing thus leads to inaccurate cutting (Frimpong-Mensah and Nagoda, 1994).

Uneven setting of saws results in the production of lumber with poor surface quality as well as dimensional inaccuracies. Too little set or too much set causes inaccurate cutting. Swaging of saws gives better dimensional accuracy than spring setting (FAO, 1985). A blade with insufficient tension has a tendency to produce wavy cuts and surfaces that are not flat. A blade with too much tension has a slack centre and buckles out to one side or the other. This also leads to inaccurate sawing (FAO, 1985).

Saw straining has a significant influence on sawing accuracy. Straining the bandsaw blades is done by raising the top wheel until, the blade is sufficiently taut. This could be done by the use of weights, hydraulic means or a combination of air pressure and hydraulics. High strain gives greater sawing accuracy and less likelihood of the

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saw slipping off the wheel but the stresses on the blade are increased as well as the need for more frequent maintenance (FAO, 1985).

Making the hook angle unduly large entails the risk that the blade will be drawn into the wood of its own accord, tearing the chips out and vibrating. This results in poor sawing and quick dulling of the edges and hence poor sawing accuracy (FAO, 1985). The gullet capacity is most important because it serves to act as the reservoir of cut sawdust whilst teeth are in the wood. Insufficient gullet capacity will lead to sawdust being forced out the side of the cut between the blade and the log resulting in increased power consumption and over heating, as a result, the stability of the blade is reduced. Reduced saw stability leads to irregular cutting. The general target is that a gullet capacity of 65-70% of the area available should be used for best result (Wood News, 1993).

2.6.2 Feed Speed

The feed speed is the speed at which the timber or work piece is fed into the machine for sawing. In the sawing of lumber, the linear length of the log expressed in centimeters which is cut at each revolution of the saw is the feed (Telford, 1958). The bandsaw requires an even and steady feed with no sudden acceleration for proper

cutting. The rate of feed must match the widths of the pieces being cut. High depth of cut requires decrease in feed speed in order to ensure good sawing accuracy. High-density woods usually require slower bandsaw blade linear speeds and consequently a slower feeding speed as indicated in **Table 2.5** (Wood News, 1993). Williston (1988) also recommended the following maximum feed speed at the various depth of cut for a 132mm (6 inches) bandmill as indicated in **Table 2.8.**

2.6.3 Operational Errors

Operational errors which can lead to inaccurate sawing include poor installation of the carriage and saw, inadequate manipulation of the dogs, careless setting, wrong positioning of the blades guides (for bandsaw)

Table 2.8. Maximum Feed Speed at Various Depth of Cut

Depth of Cut (mm)	Feed Speeds for a Vertical (m/min)
228	93
305	68
381	53
457	44
610	32

Source: Lumber Manufacturing; The design and operation of Sawmills and planner mills. Williston(1988)

and wrong adjustment of cleaver (ie in circular ripsaws) (FAO, 1985).

Carriage dogs are used to hold the log firmly in position. This has to be manipulated correctly such that the log is held in the most favorable position for sawing. If the log is loosely held it moves during sawing, giving rise to uneven thickness (Frimpong-Mensah and Nagoda, 1994).

In band sawing, the blade guides serve to keep the blade running through. It is important from consideration of dimensional accuracy that the distance between the blade guides and the log surface should be as short as possible and should be adjusted according to the size of the log being cut. Wrong adjustment will give inaccurate cuts (Frimpong-Mensah and Nagoda, 1994).

2.7 Quality Control

Variation in all operating systems requires the need for quality analysis and quality control. Although variation cannot be eliminated by learning more about it, it can be controlled in order to increase the number of products from the operating system that conform to usage requirement.

A Statistical Process Control (SPC) system is a powerful system of problem solving tool, which seeks to detect and eliminate non-random (Sporadic) variations as they arise while the process is operating. The process is monitored periodically by examining sample units of output. This ensures reduction of variability in order to improve quality.

Quality itself can be defined in various ways. To Dening (1982), quality can be defined in two ways: the quality of conformance which is the extent to which a producer surpasses the design specifications required to meet customers needs, and the quality of performance which is the measure of how well products perform in service.

Crosby (1985) defines quality as the conformance to requirements. In the context of lumber, Brown (1982) defines quality in the broad sense as caring through the manufacturing process and providing quality assurance in the finished product. Under this project the quality characteristics that are of interest are the surface quality and the thickness of lumber. Lumber with poor surface quality result in either down grading of the lumber or excessive planning of the lumber, which leads to lost of revenue. Also deviation in target size of lumber is a cost solely to the producer. **Table 2.9** depicts the

cost that could be incurred by a producer as a result of the addition of excess tolerance of 1mm, 2mm and 3mm to the saving of various dimensions of lumber.

Table 2.9 Lumber Lost for Additional or Excess Tolerance

Excess	25mm Lumber Board		38mm Lumber Board		50mm Lumber Board	
Addition of sawing Tolerance	Lost on thickness	Lost on every 100m³	Lost on Thickness	Lost on Every 100m³	Lost on Thickness	Lost on Every 100m³
1mm	4%	4m³	2.6%	2.6m³	2%	2m³
2mm	8%	8m³	5.3%	5.3m³	4%	4m³
3mm	12%	12m³	7.9%	7.9m³	6%	6m³

Source: Tolerance on Green Lumber Dimension for Selected Tropical Timber of Ghana. Sagoe, J. A. and S. Hellem. (1998)

Other costs could be the lost of good-will as well as rejection of consignment by the buyer. If we like to have at least 90% of the total production to fall within the given limits we must multiply the standard deviation by 1.65. Ten percent of the consignment is often the allowance accepted by most buyers (Sagoe and Hellen, 1998).

In any production system there are two sources of variability namely, variation due to assignable causes and that due to chance causes. A system operating with the presence of only chance causes of variation is said to be in statistical control. The assignable causes present in

a process might be due to improperly adjusted machines, environmental problems, operator's errors or defective raw materials. Such variability is very large compared to those due to chance and when present renders the process to operate within unacceptable levels of performance. The process is then said to be out of control. The major objective of SPC is to quickly detect occurrence of assignable causes by measuring product quality variable and attribute. After the required statistics of the quality parameters of interest are estimated these values are plotted against their specific sample number according to the time of production. The charts obtained is referred to as control charts which display the trends and patterns that the estimators follow with respect to the specification limits of the process. In general the objective of a statistical control of quality is to achieve a process that is stable, predictable and capable to deliver products that meet the requirement of the customer almost all the time.

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CHAPTER THREE

3.0 MATERIALS AND METHODS

3.1 Area of Study

The research work was carried out at the FABI Timbers Limited. The company is located at Maakro along Abuakwa-Nkawie Road in Kumasi. It was established on the 27th February 1987 on a 50-acre leasehold land. FABI Timbers Limited currently has a total of about six hundred (600) work force. Included in this are seven expatriates and three Ghanaian management staff. The managing director is Gerci Lucian and the general manager is Italio Alberti. The company manufactures wooden products for export and the local market. Among the products they produce are:

i) Kiln dried lumber

ii) Finished Flooring Material (Parquet)

iii) Tongue and Groove (T&G) solid wood

iv) Tongue and Groove (T&G) with veneer lamination

v) Skirting Board

vi) Corner Battens

vii) Ceiling Battens

viii) Door and Window Frames, and

ix) Doors.

3.2 Factory Production Layout

The production layout includes logyard, bandmill headrigs for primary and secondary breakdown, drying, tongue and

groove, skirting board etc, sections. The mill has a one acre logyard which is close to the primary breakdown section. It is meant to contain a buffer stock of logs in order to ensure continuous production. The bandmill section consists of seven bandmills for which five are for primary breakdown as indicated in **Figure 3.1** and the other two for secondary breakdown. The primary breakdown bandmills are made up of four vertical bandmills and one horizontal bandmill.

At the saw shop there are two saw doctor's bench, one bench for swaging of saws, two sharpening machines and two side dressing machine.

3.3 Method Of Data Collection

The study was carried out through direct measurements. A 1328mm bandmill with light auto feed carriage was used in this experiment. The rated power of the main motor was 110hp and the speed was 1440rpm. The circumference of the bandmill was measured with a measuring tape from which the diameter of the wheel was estimated. Eight bandsaw blades with similar dimensions and specifications as recorded in **Table 3.1** were randomly selected from a total of ten bandsaw blades for the study. Four of the selected saws were stellite-tipped whilst the other four were swaged-set. The swage setting was done with a manual swage-set

Resaw

Resaw

Platform For Keeping Saws

Vertical Bandmill

Crosscut Machine

Edger

Crosscut Machine

Edger

Sharpening & Side Dressing Machine

Pipe

Welding Bench

Multiple Edger

Crosscut Machine

Vertical Bandmill

Horizontal Bandmill

Vertical Bandmill

Vertical Bandmill

Sharpening & Side Dressing Machine

Saw Doctor's Bench

Saw Doctor's Bench

Access Road

Access Road

Figure 3.1 A Plan of the Sawmill and the Sawshop.

→ Flow direction of lumber

machine with serial number 55-15. The stellite tipping was done by depositing a stellite No.12 which is composed of 58% cobalt, 29% chromium and 13% tungsten on the teeth of the saws by the conventional method, that is the rod of the stellite 3.2mm in diameter was melted with an oxyacetylene flame and their melted pieces were manually welded unto the rake faces of the swage teeth. The four stellite-tipped saws were sharpened and side-dressed with a Vollmer Werke 7950 Biberach machine, which has a fabrication number of 1135.

Table 3.1 Specifications of the Bandsaws used

Features \ Saws	S_1	S_2	S_3	S_4	Sw_1	Sw_2	Sw_3	Sw_4
Blade Width (mm)	152.1	152.3	152.00	151.7	149.9	150.6	151.3	151.8
Blade thickness (mm)	1.29	1.29	1.28	1.29	1.28	1.29	1.28	1.28
Number Of teeth For each saw	209	209	209	209	209	209	209	209
Tooth Pitch	45.00	45.10	44.45	45.00	44.90	45.00	45.00	44.95
Tooth height (mm)	16	16	16	16	16	16	16	16
Rake angle (°)	27	27	27	27	27	27	27	27

Legend: S_1, S_2, S_3, S_4 - Stellite- tipped saws
Sw_1, Sw_2, Sw_3, Sw_4 - Swage- set saws

The kerf widths of all the 209 teeth of each of the eight bandsaws blades were measured with an automatic or digital

vernier caliper with serial number 295906 and model number CD-15Cp. The inner and outer side clearance of each of the four stellite-tipped saws were measured with a dial indicator. The measurement was done three times for each of the saw teeth and the averages taken. The thickness of the saw blades, which were used, was also measured with a micro-meter screw gauge at three different points on each of the saw blades. The pitch and the height of tooth were measured with a vernier caliper and ruler respectively.

The eight bandsaws were then used to rip saw beams of Wawa (*Triplochiton scleroxylon)* into a nominal thickness of 41.00mm at an average feed speed of 13.22m/min. The average feed speed was determined by measuring the length of the beam with a steel tape and the average time required to saw a board on three different occasions with a stop clock. The height and the length of the beams of Wawa (*Triplochiton scleroxylon)* were 420mm and 360cm respectively. Ten boards were randomly sampled from the first fifteen boards produced whenever each of the bandsaw blades was used to saw the beam.

The thickness of the sawn boards were measured with a 200x0.05mm vernier caliper at ten locations along the top and bottom edges on each board as indicated by **Figure 3.2.** The lumber thickness was measured at 30cm from both ends of the board and subsequent measurements were taken at

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intervals of 75cm.

The moisture content of the Wawa boards (*Triplochiton scleroxylon*) was taken with a moisture meter with serial number 07-12-12909. The average moisture content of the green lumber was 63.6%.

The experiment was repeated for the stellite-tipped saws. This time the inner and the outer side clearances of the Stellite-tipped saws were measured at anytime the saws were sharpened. The saws were then used to rip-saw Wawa(*Triplochiton scleroxylon*) beams at an average moisture content of 63.6% into boards of nominal thickness of 41.00mm and width 420mm. A random sample of ten boards were made from the first fifteen boards produced for each value of side clearance and the thickness of the boards were measured as it was done earlier on. The surface smoothness of the sampled boards were also qualitatively graded into 1,2,3,4,5, which corresponds to surface smoothness: very poor, poor, good, very good, and excellent respectively using the surfaces shown in **Figure 3.3a-e** and two MSc. Wood Technology students. The experiment was repeated at anytime the saws were sharpened for decreasing side clearance of the saws.

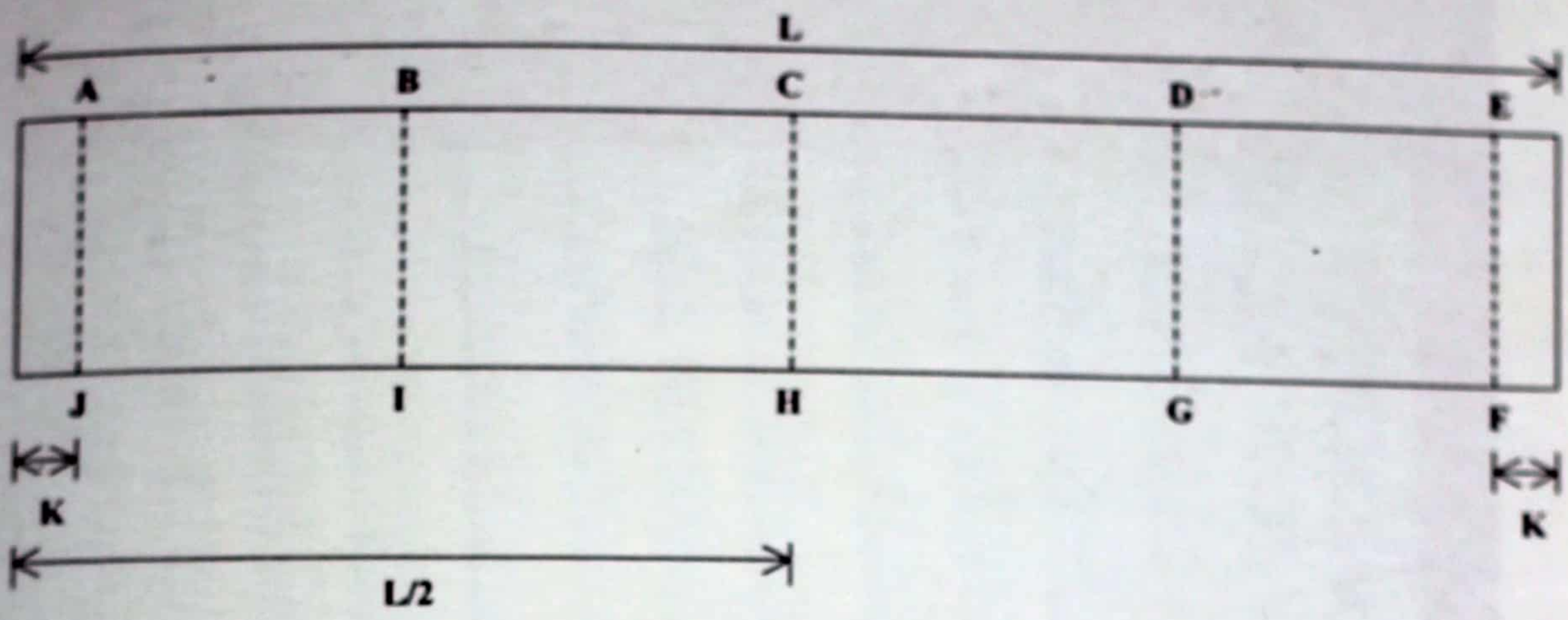


Figure 3.2: Points of measurement on board.

L - Total length of the lumber

L\2 - Half of the length of the lumber.

K - Distance of approximately 30cm from the ends of the lumber.

A,B,C,D,E,F,G,H,I,J - Points measured on the lumber.

As part of the study beams of Wawa (*Triplochiton scleroxylon*) of different heights were sawn into boards of norminal thickness 41.00mm. The thickness of the boards were measured as it was done earlier on. Thickness of sawn boards were also taken for different depth of cut of lumber. Lastly six boards were sampled from each pallet of sawn boards during the production process to find out if the entire production process was within accepted levels.

In all forty sampling was done.

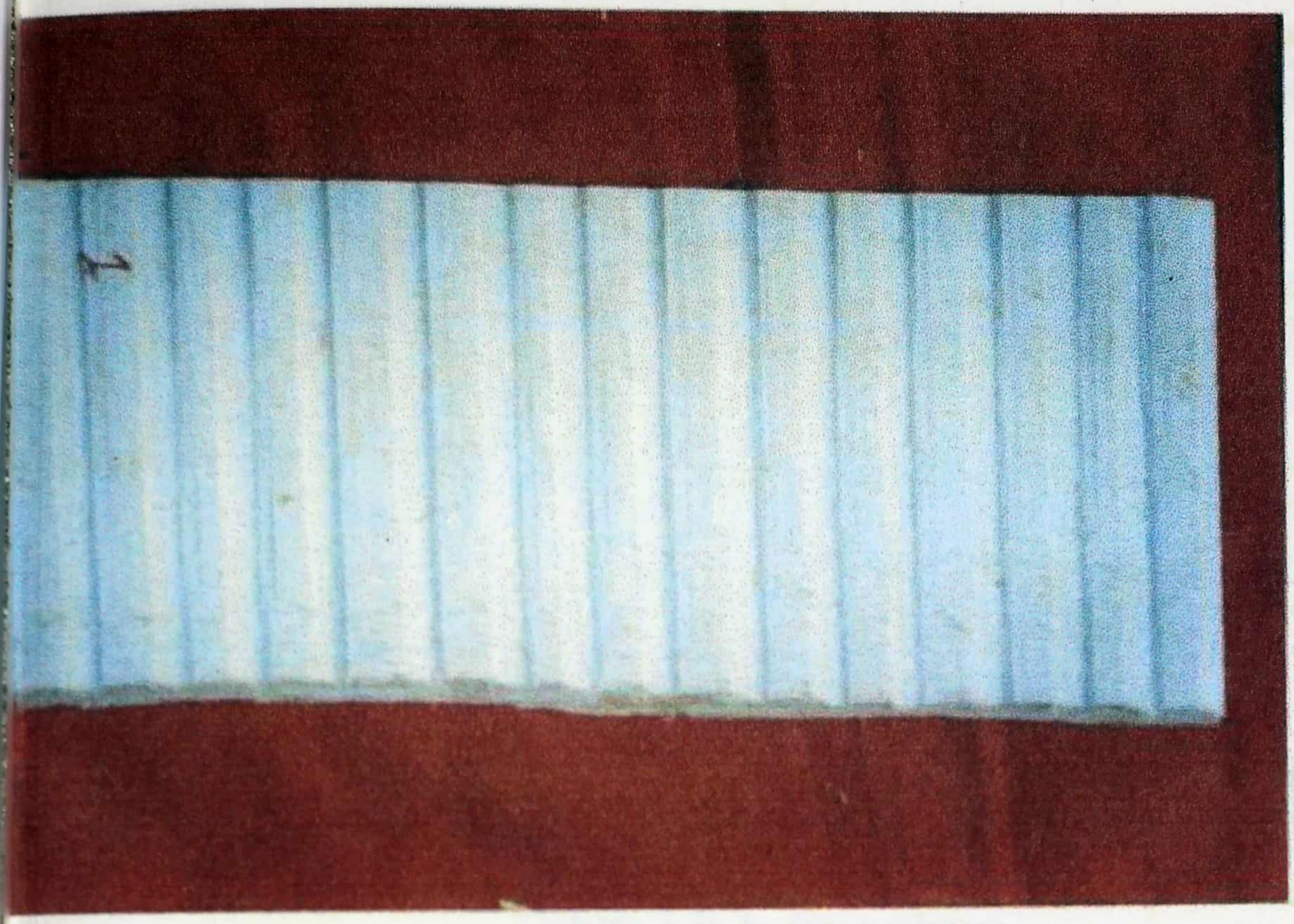


Figure: 3.3a surface (one)

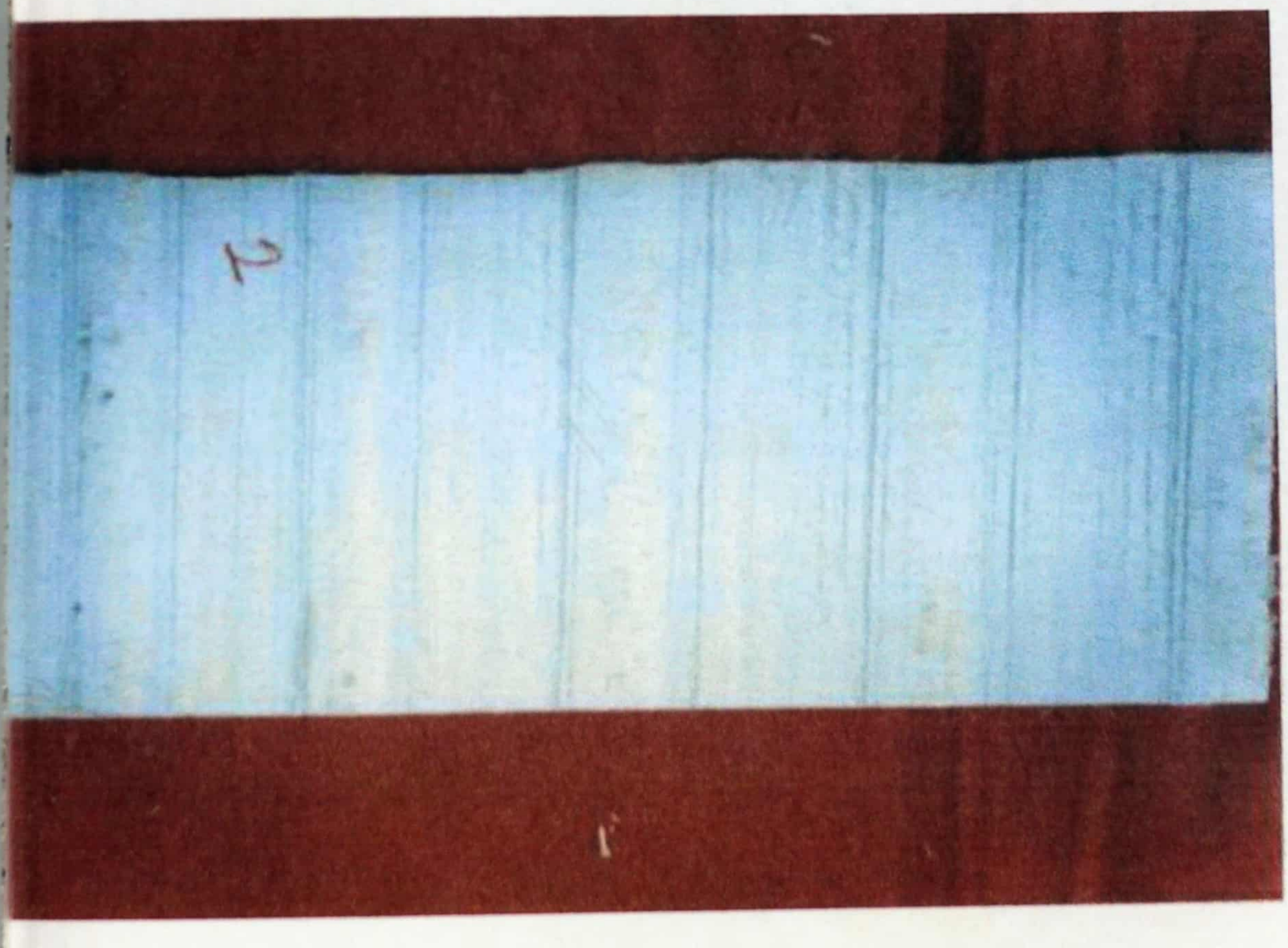


Figure: 3.3b Surface (two)

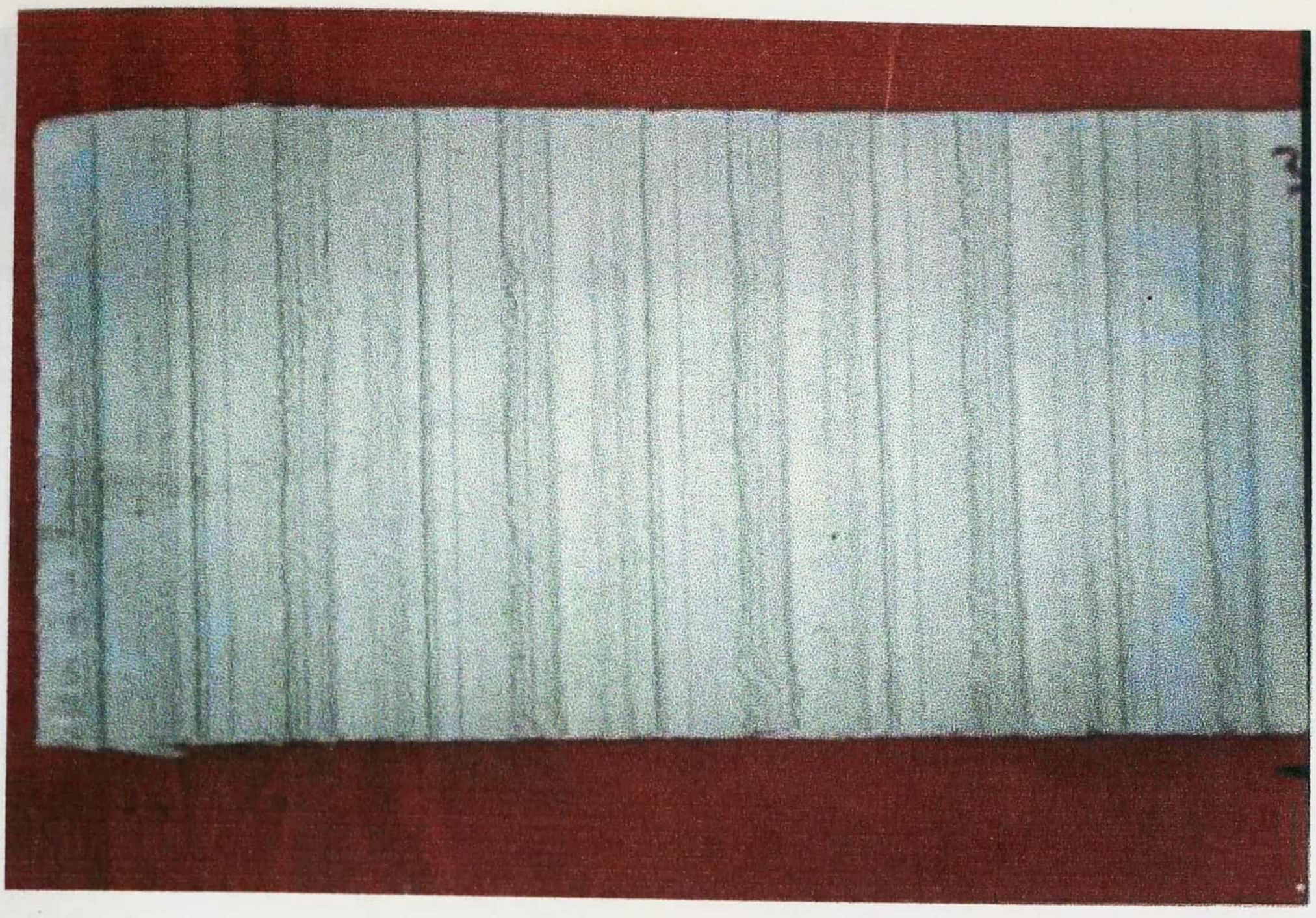


Figure: 3.3c Surface (three)

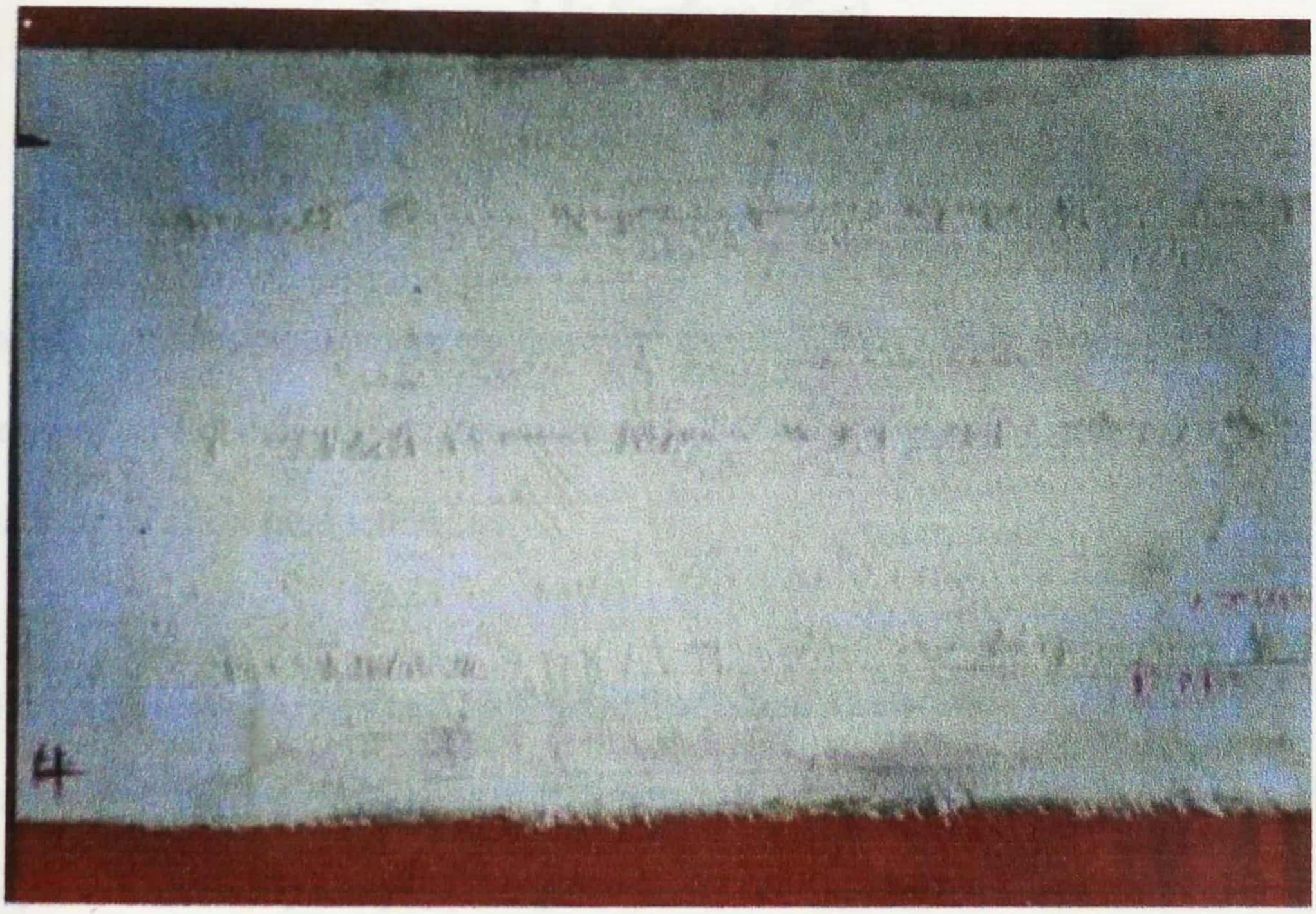


Figure: 3.3d Surface (four)

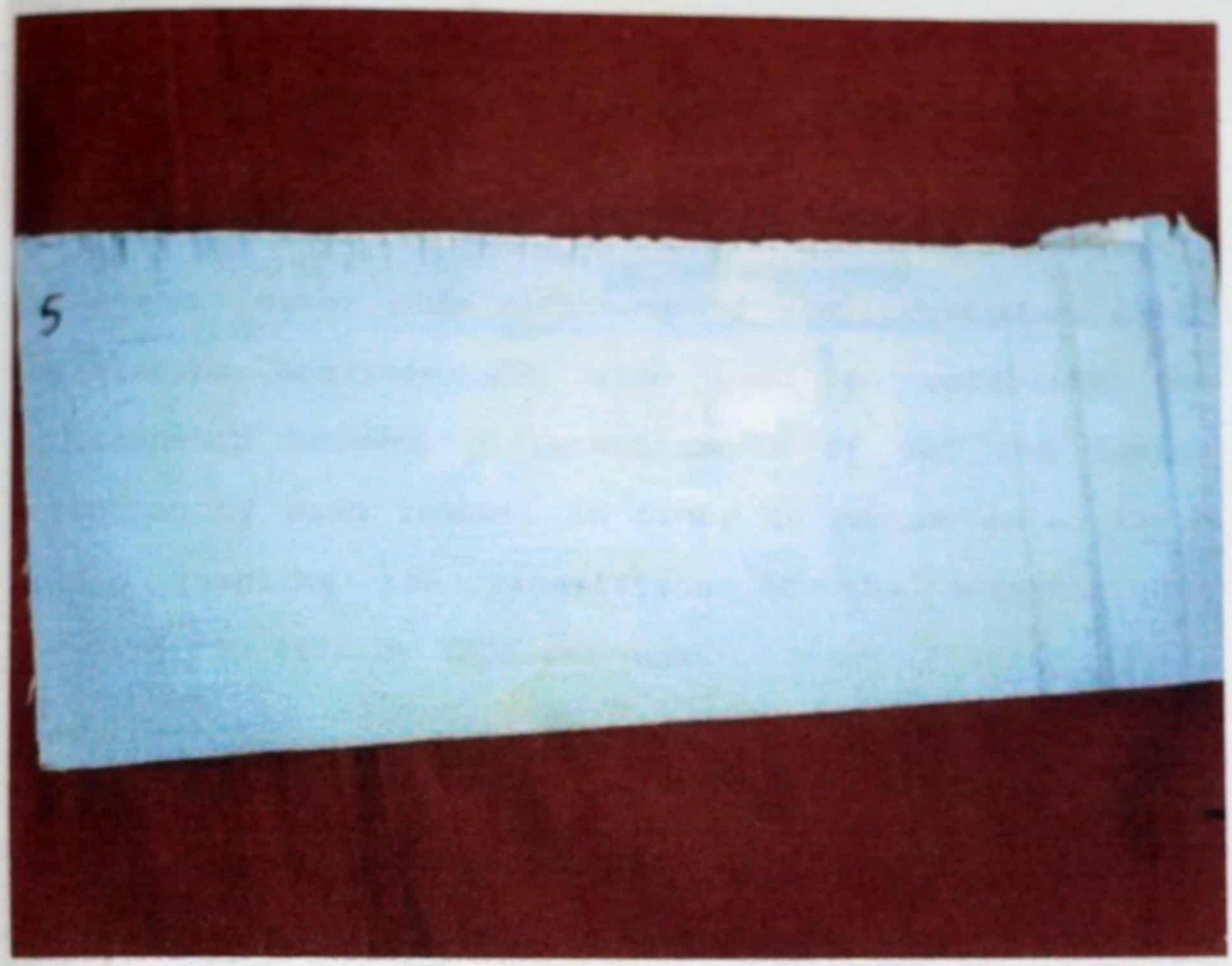


Figure: 3.3e Surface (five)

Besides the direct measurements done the researcher also made direct observation of the operators, saw doctors etc. to determine any possible operational errors that could be made which could affect production.

3.4 Experimental Design and Method of Statistical Analysis

A completely randomised design (CRD) was used for the data collection. The data for the study was statistically analysed using Excel 1997 and manual calculator. Analysis of variance was used to test for significant difference

between the kerf width of swage-set bandsaw blades and stellite-tipped bandsaw blades. The student T-test was also used to test for significant difference between the inner and outer side clearance of stellite-tipped saws. Correlation analysis was also used to establish the relationship between different depth of cut and sawing variation of sawn lumber. In order to ensure an accurate random sampling the translation of the international standard ISO 4470 by TEDB was used.

3.5 Limitation

Though the researcher had wanted to use a more sensitive device for measuring the surface quality of the sawn lumber, the non-availability of such a device in Ghana made him use an improvised surfaces for measuring the surface smoothness of the sawn lumber. Also the researcher had wanted to extend the study to cover other wood species, however inadequate finance, unwillingness of the sawmillers to change their production schedule as well as time constraint did not allow him to do so.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 The Accuracy of Kerf Width

The accuracy of the kerf width of bandsaw blades is influenced by the technique of setting and sharpening. An uneven kerf width causes not only badly sawn surface and greater sawing forces but also snaking of the saw. It is therefore important that bandsaw blades are prepared to maximum accuracy to ensure good sawing performance.

The saws used for this research work were swage-set and stellite-tipped saws. The result is as summarized in **Table 4.1** with the raw data presented in appendix 1a-d and 2a-d. The summarized results indicate that the kerf width for the stellite-tipped saws were generally greater than that of the swage-set saws. On the average the mean kerf width for the stellite-tipped saw was 4.20mm and that of the Swage-set saw was 3.06mm.

The statistical analysis as shown in **Table 4.2** reveals that at 5% level of significance the kerf width of the stellite-tipped saw was significantly bigger than the kerf width of the swage-set saw. This results deviate from the assertion by Denig (1993) and Wood News (1993) that a simple rule for the required kerf of a blade is to multiply the blade thickness which was 1.3mm by two for

Table 4.1. Kerf Width of Stellite-tipped and Swage Set Bandsaw Blades.

Saws	Types of Saw Setting			
	Stellite-tipped		Swage-set Saws	
	Mean Kerf Width (mm)	SD (mm)	Mean Kerf Width (mm)	SD (mm)
1	4.02	0.2789	3.08	0.3511
2	4.48	0.2255	3.04	0.3940
3	4.25	0.2785	3.34	0.4341
4	4.04	0.1537	2.76	0.3739
All Four	4.20	0.2397	3.06	0.3895

LEGEND: SD-Standard Deviation

Table 4.2 Analysis of Variance for Kerf Width

Source of Variation	df	SS	MS	Fcal	Fcritical (5%)
Saw setting	1	2.6145	2.6145		
Error	6	0.3027	0.0505	51.8	10.1
Total	7	2.9072			

LEGEND: df = Degree of freedom

SS = Sum of squares

MS = Mean squares

which in this case should have been about 2.6mm. The high kerf width for the stellite-tipped saw was due to high amount of stellite material deposited on the tooth tips of the sawblade. However the high kerf width of the sawge-set saw was due to the use of the two hammers by the saw

doctor for side dressing instead of using the conventional hand tool. Since according to Uddeholm Strip Steel AB (1989) the side dressing is meant to press the sides of each tooth to the required uniform width.

The result also show that the standard deviation of the kerf width of the swage-set saw was higher than that of the stellite-tipped saw as shown in **Table 4.1**. On the average the spread of the saw kerf about the mean for swage-set saws was 0.3895mm and that for the Stellite-tipped saw was 0.2397mm. This result is higher than that obtained by Kohji *et al*, (1993) for three saws as indicated in **Table 2.6** for which he deemed comparable to results obtained in other saw shops. The high standard deviation of the saw kerf for the swage-set may be due to the fact that at the sawmill used for the study the saw doctor uses two hammers to equalize the saw teeth after swaging instead of using a shaper machine, which could have given an accurate result. Though the results as indicated in **Table 4.1** show that the standard deviation of the kerf width for the swage-set is bigger than that of the stellite-tipped saw, statistical test of variance at 5% level of significance as indicated in **Table 4.3** shows that there is no significant difference between the standard deviation of the kerfs of the two saws.

Table 4.3 Test of Variance for Stellite-tipped and Swage-set Saws.

Saws	Pooled SD	Variance (SD^2)	Fcal	Fcritical (5%)
Stellite-tipped	0.2397	0.0575		
			2.64	15.44
Swage-Set	0.3895	0.1517		

LEGEND : $Fcal = SD^2_1/SD^2_2$ $SD^2_1 > SD^2_2$

SD = Standard Deviation

4.2 Sawing Accuracy of Bandsaw Blades

Saws which provide good sawing performance have been a great demand in the wood industry. This is to ensure greater efficiency in the wood industry. The results obtained from sawing a beam of wawa (*Triplochiton scleroxylum*) with stellite-tipped and swage-set saws are as indicated in **Table 4.4** with it semi processed data presented in **appendix 3 and appendix 4**. The results in **Table 4.4** show that the *standard deviation within* board which indicates saw inaccuracy or saw instability was greater than standard deviation *between* board which indicates the repeatability or repeating accuracy of the set work for both types of setting.

The results in **Table 4.4** also indicate that the standard deviation *within* board and between boards as well as the

total standard deviation for the boards produced from the stellite-tipped saws were greater than that of the swage-set saw. Sagoe and Hellem (1998) indicated that if the standard deviation *within* board is greater than that *between* board then the most probably reason for the sawing variation could be found with sawblade.

The characteristics of the bandsaw blade that could attribute to sawing inaccuracy are: uneven saw kerf, too big or too small saw kerf width, dull teeth, insufficient tensioning, straining of the saw etc. In this study, the features of the saws used were homogeneaous as indicated in **Table 3.1**. The saws were also adequately sharpened and tensioned by an experienced saw doctor. Both of the saw types were also given adequate strain. It could be observed from **Table 4.3** that at 5% level of significance there was no significant difference between the accuracy of kerf width of stellite-tipped and the swage-set saws. It was therefore expected that the two saws would have provided the same level of sawing accuracy. However the results from **Table 4.2** indicate that there was significant difference between the kerf width of the two types of saws. It could therefore be deduced that the high difference in sawing accuracy between the stellite-tipped saw and that of the swage-set saw was more influenced by the kerf width.

Table 4.4 Sawing Variation of Sawn Lumber Thickness (mm)

Saw Number	1			2			3			4		
Saws	SD-wb	SD-bb	SD-t	SD-wb	SD-bb	SD-t	SD-wb	SD-bb	SD-t	SD-wb	SD-bb	SD-t
Stellite-Tipped	1.2406	0.7860	1.4686	1.4778	0.3853	1.5272	1.3599	0.6139	1.4920	1.1568	0.6525	1.3281
Swage-Set	0.9345	0.3383	0.9939	1.0519	0.5145	1.1710	1.1229	0.5319	1.2426	0.8931	0.1579	0.9070

Legend : SD-wb=Standard Deviation Within Board

SD-bb=Standard Deviation Between Board

SD-t=Total Standard Deviation

According to Denig (1993) and Wood New (1993) the kerf width of the bandsaw should be about twice the blade thickness. If the kerf width of the bandsaw blade is too large it can result in sawdust spillage between the sawblade and the surface of the sawn lumber. Some of the sawdust clung unto the wood surface as shown in **Figure 4.1** hence resulting in increased friction between the saw blade and the sawn board surface and subsequent heating of



Figure: 4.1 Sawdust clung unto sawn board surface

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the sawblade which in turn lead to the snaking of the sawblade and subsequent sawing variation.

4.3 Side Clearance and Sawing Variation of Bandsaw Blades

Side clearance is provided on bandsaw blades to reduce friction between the sawblade and the sawn board surface. According to Lemaster (1986) too big saw kerf width and for that matter too big side clearance can result in the snaking of the sawblade. Again too small side clearance will also result in the snaking of the sawblade. The results obtained from the relationship between side clearance and sawing variation are as indicated in **Tables 4.5, 4.6, 4.7 and 4.8**. These results which were estimated from **Appendix 10a & b, 11a & b, 12a & b and 13a & b** shows that generally as the side clearance of the four saws decrease the standard deviation within boards, the standard deviation between boards and the total standard deviation decreased up to some minimum value and increased again.

A graph of standard deviation against side clearance as indicated in **Figures 4.2, 4.3, 4.4, 4.5** shows a quadratic relationship between standard deviation within boards, standard deviation between boards, total standard deviation and side clearance.

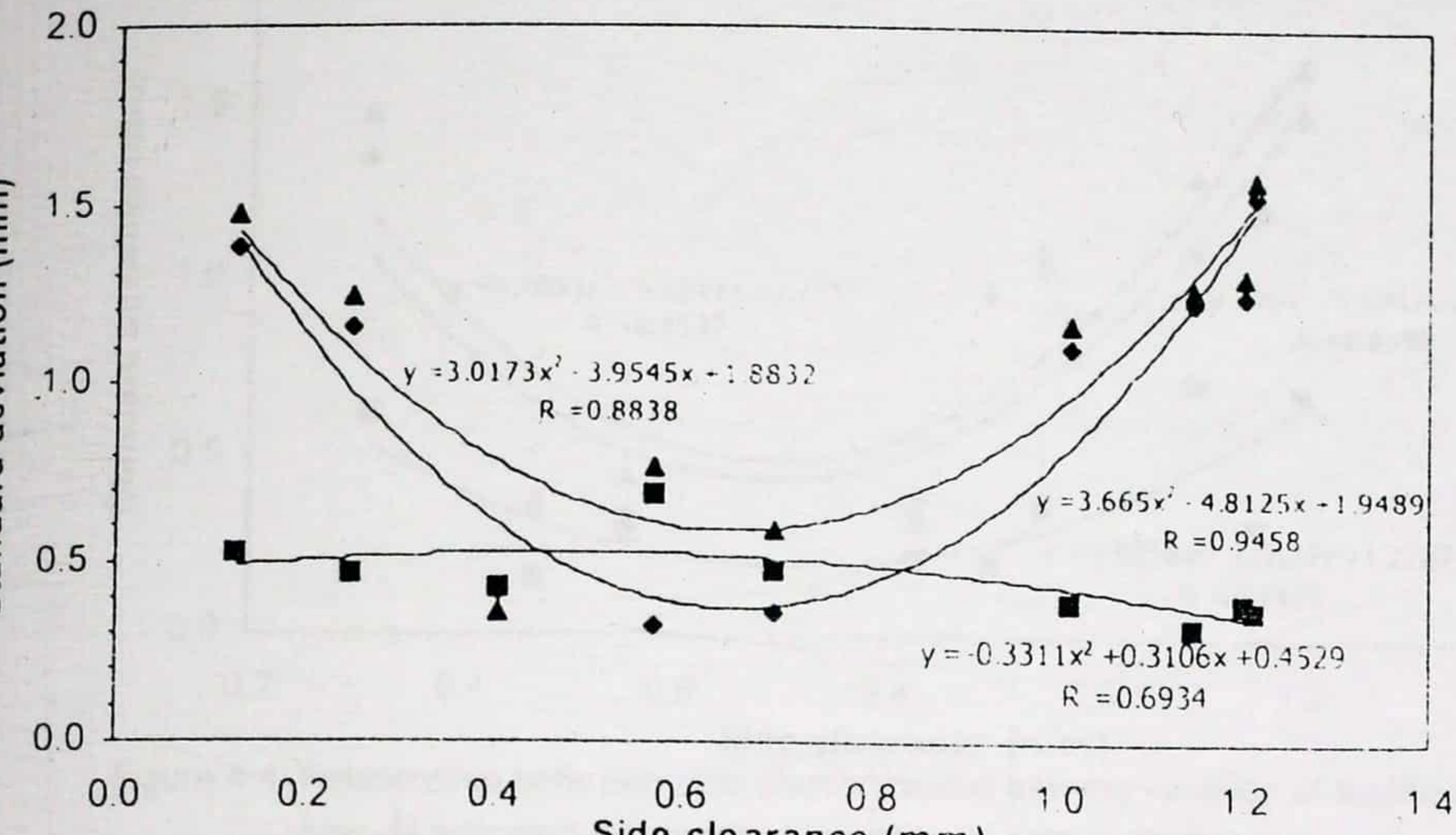


Figure 4.2: Relationship between side clearance and sawing variation of stellite-tipped saw-k indicated by standard deviation of lumber thickness

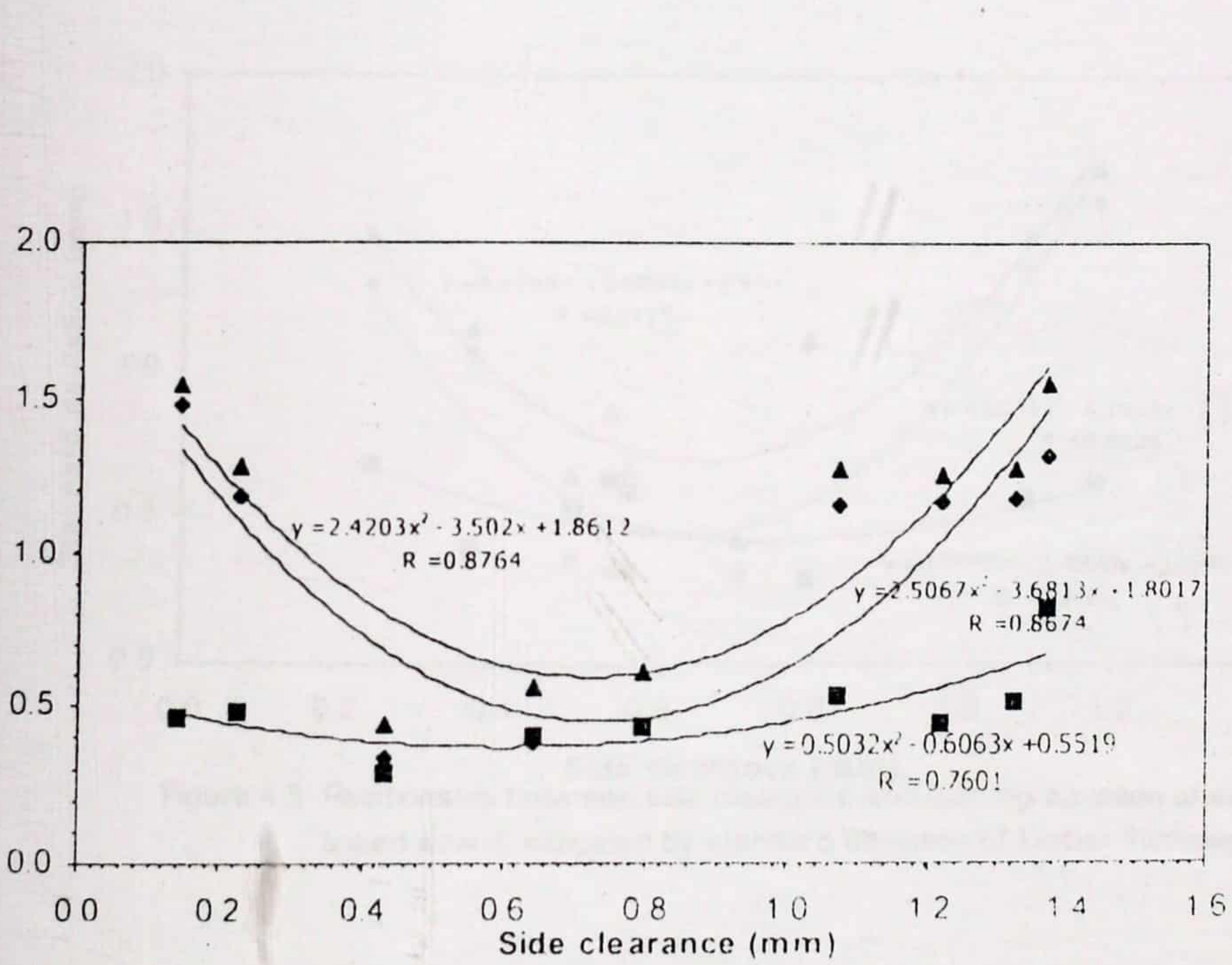


Figure 4.3 Relationship between side clearance and sawing variation of stellite-tipped saw-N indicated by standard deviation of lumber thickness

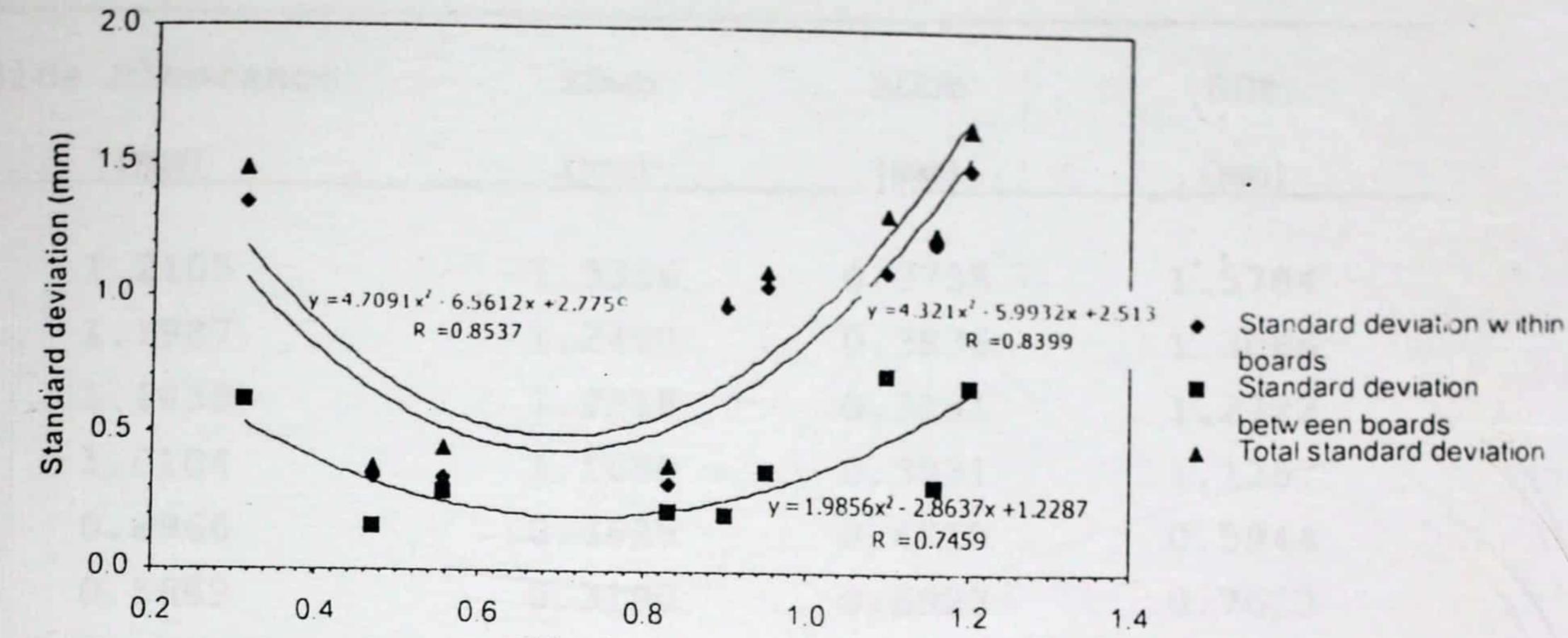


Figure 4.4: Relationship between side clearance and sawing variation of stellite-tipped saw -M indicated by standard deviation of lumber thickness

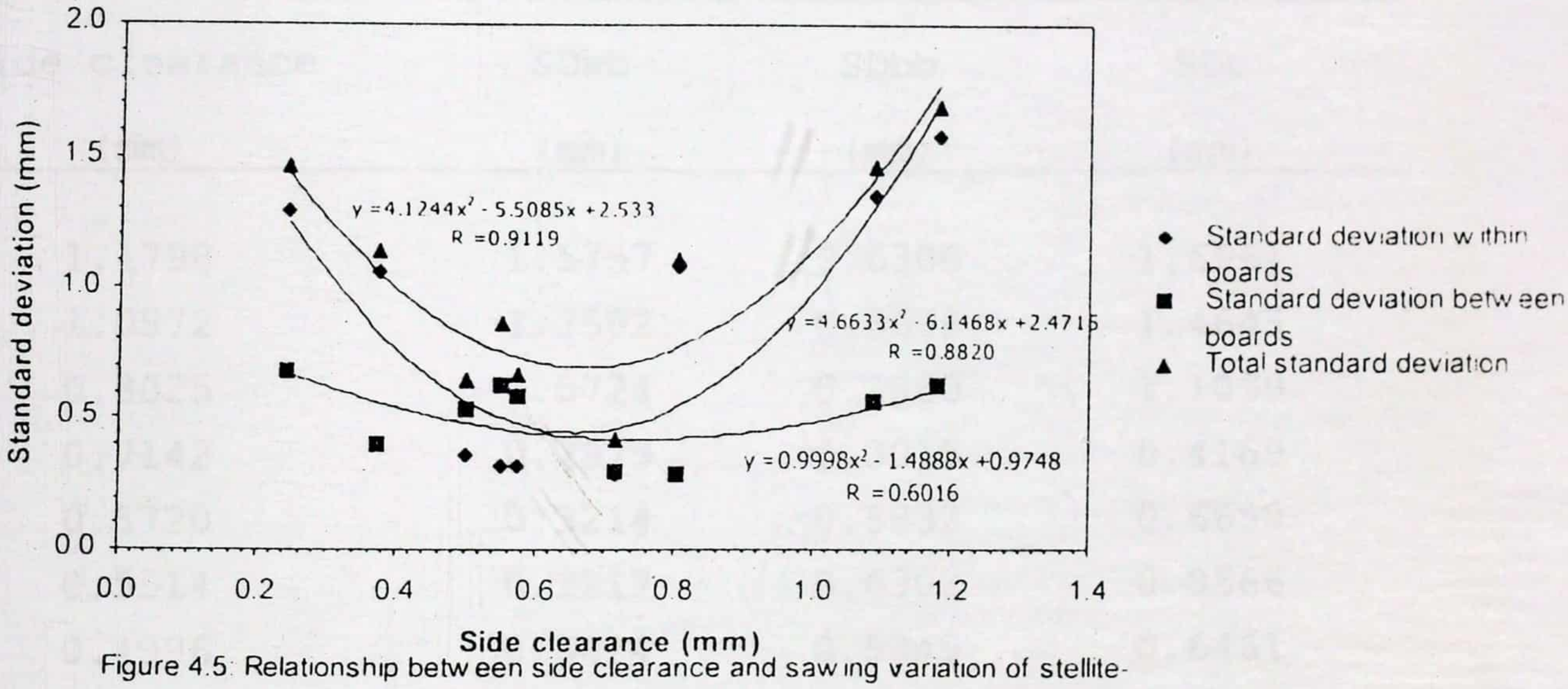


Figure 4.5: Relationship between side clearance and sawing variation of stellite-tipped saw -L indicated by standard deviation of lumber thickness

Table 4.5.Side Clearance and Sawing Variation (Stellite-K)

Side clearance (mm)	SDwb (mm)	SDbb (mm)	SDt (mm)
1.2105	1.5336	0.3735	1.5784
1.1987	1.2490	0.3836	1.3066
1.1439	1.2318	0.3181	1.2722
1.0104	1.1080	0.3931	1.1757
0.6966	0.3625	0.4710	0.5944
0.5689	0.3190	0.6923	0.7623
0.4035	0.4222	0.4243	0.3583
0.2481	1.1508	0.4660	1.2416
0.1275	1.3819	0.5275	1.4792

Legend: SDwb = Standard Deviation Within Boards
SDbb = Standard Deviation Between Boards
SDt = Total Standard Deviation of Boards

Table 4.6.Side Clearance and Sawing Variation (Stellite-L)

Side clearance (mm)	SDwb (mm)	SDbb (mm)	SDt (mm)
1.1798	1.5757	0.6300	1.6961
1.0872	1.3502	0.5668	1.4643
0.8025	1.0724	0.2860	1.1099
0.7142	0.2879	0.3015	0.4169
0.5720	0.3214	0.5832	0.6659
0.5514	0.3217	0.6302	0.8566
0.4996	0.3624	0.5349	0.6461
0.3718	1.0593	0.4035	1.1336
0.2424	1.2956	0.6784	1.4625

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Table 4.7.Side Clearance and Sawing Variation (Stellite-M)

Side clearance (mm)	SDwb (mm)	SDbb (mm)	SDt (mm)
1.2009	1.4957	0.6840	1.6447
1.1590	1.2178	0.3187	1.2588
1.1007	1.1086	0.7271	1.3258
0.9513	1.0447	0.3699	1.1083
0.8996	0.9687	0.2100	0.9912
0.8319	0.3158	0.2169	0.3831
0.5576	0.3328	0.2914	0.4424
0.4723	0.3345	0.1626	0.3719
0.3108	1.3431	0.6116	1.4758

Table 4.8.Side Clearance and Sawing Variation (Stellite-N)

Side clearance (mm)	SDwb (mm)	SDbb (mm)	SDt (mm)
1.3710	1.3140	0.8213	1.5496
1.3242	1.1684	0.5085	1.2743
1.2188	1.1656	0.4476	1.2486
1.0706	1.1523	0.5346	1.2703
0.7937	0.4287	0.4347	0.6105
0.6424	0.3860	0.4077	0.5614
0.4336	0.3360	0.2899	0.4438
0.2228	1.1832	0.4869	1.2795
0.1389	1.4789	0.4677	1.5511

Legend: SDwb = Standard Deviation Within Boards
SDbb = Standard Deviation Between Boards
SDt = Total Standard Deviation of Boards

Extracts from the graphs, as indicated in **Table 4.9** shows that on the average an optimal side clearance of 0.69mm is required to saw Wawa (*Triplochiton scleroxylon*) to produce an average minimum of 0.42mm, 0.33mm and 0.59mm standard deviation *within* boards, standard deviation between boards and *total* standard deviation respectively.

Table 4.9: Extracts from the Graph of Relationship between Side Clearance and Sawing Variation(mm).

Saws	K	L	M	N	Mean of all four
SC (mm)	0.66	0.66	0.70	0.72	0.69
SD_{WB} min	0.36	0.44	0.44	0.44	0.42
SDbb(min)	0.53	0.44	0.20	0.36	0.33
SD_T min	0.60	0.68	0.48	0.60	0.59

LEGEND :SC = Side Clearance
SD_{WB}min = Minimum Within Board Sawing Variation
SD_Tmin = Minimum Total Board Sawing Variation
SDbb-min= Minimum between Board Sawing Variation
K, L, M, N, refers to stellited saw used.

However extracts from **Tables 4.5,4.6,4.7,4.8** as indicated in **Table 4.10** shows that between the side clearance value of 0.8319mm which occurred for stellite-m and a side clearance value of 0.4336mm which occurred for stellite-N, the standard deviation within boards which has a direct relationship with saw performance was minimum having an average value of 0.3147mm. This results show that a

minimum within boards sawing variation of Mawa (*Triplochiton Scleroxylon*) could be obtained if the 152mm (6 inches) bandsaw blade is set within the range of 0.8319mm and 0.4336mm. For side clearance values greater than

Table 4.10: Extracts from the Tables of Side Clearance against Sawing Variation of stellite-tipped Saws

Saws	Minimum SDwb(mm)	Corresponding values for Sd-wb(min) Side Clearance (mm)	SDbb (mm)	Sdt (mm)
K	0.3190	0.5689	0.6923	0.7623
L	0.2879	0.7142	0.3020	0.4169
M	0.3158	0.8319	0.2169	0.3831
N	0.3360	0.4336	0.2899	0.4438

Legend: SDwb = Standard Deviation Within Boards
SDbb = Standard Deviation Between Boards
SDt = Total Standard Deviation of Boards

0.8319mm there will be spillage of sawdust between the sawblade and the surface of the sawn lumber, which will result in the snaking of the saw. Also side clearance values below 0.4336mm will be too small for sawing Wawa (*Triplochiton Scleroxylon*). This will result in increased friction between sawblade and the surface of the sawn lumber, resulting in the heating of the sawblade and

subsequent snaking of the saw.

Although Denig (1993) and Uddeholm Strip steel AB(1989) recommended side clearance values between 0.306mm to 0.357mm and between 0.30mm to 0.45mm respectively for the sawing of hardwood, the soft texture and the high moisture content of about 63.6% of Wawa (*Triplochiton scleroxylon*) sawn at this mill demands a relatively high side clearance values.

4.4 Accuracy of Side Clearance of stellite-tipped Saws and Surface Smoothness of Sawn Lumber

The results obtained from the relationship between the accuracy of side clearance and surface smoothness of sawn lumber as indicated in **Tables 4.11, 4.12, 4.13 and 4.14.** This result shows that higher values of standard deviation of side clearance produced poor surfaces. The graphs of the relationship between the accuracy of side clearance of stellite-tipped saw and surface smoothness of sawn lumber as indicated in **Figures 4.6a&b, 4.7a&b, 4.8a&b and 4.9a&b** shows a strong linear relationship between accuracy of side clearance and surface smoothness of stellite-tipped saw for the surfaces that corresponds to L-out, K-out, K-in and Nout. This means that as the standard deviation of the side clearance increased the surface smoothness of the sawn boards decreased or become poorer.

Table 4.11: Accuracy of Side Clearance of Stellite-tipped Saw-L and surface Smoothness of Sawn Lumber

SD(mm)		Surface Smoothness of Sawn Lumber	
Out	In	Out	In
0.1231	0.1576	5	3
0.1133	0.1549	5	3
0.1309	0.1564	5	3
0.1241	0.1409	5	4
0.1498	0.1694	4	3
0.1668	0.1827	3	3
0.1441	0.1829	2	3
0.1643	0.1680	3	3
0.1467	0.1389	4	4

Legend: SD-Standard deviation

Table 4.12: Accuracy of Side Clearance of Stellite-tipped Saw-K and surface Smoothness of Sawn Lumber

SD(mm)		Surface Smoothness of Sawn Lumber	
Out	In	Out	In
0.0868	0.0703	5	5
0.0760	0.0798	5	5
0.0902	0.0866	5	5
0.0945	0.3562	5	1
0.3324	0.1765	1	3
0.1723	0.1680	3	3
0.1442	0.1397	4	4
0.1201	0.1140	5	5
0.0908	0.1038	5	5

Legend: SD-Standard deviation

Table 4.13: Accuracy of Side Clearance of Stellite-tipped Saw-M and surface Smoothness of Sawn Lumber

SD(mm)		Surface Smoothness of Sawn Lumber	
Out	In	Out	In
0.1621	0.1373	3	4
0.1877	0.1693	3	3
0.1895	0.1750	2	3
0.1885	0.1883	3	3
0.1746	0.1857	3	3
0.1669	0.1799	3	3
0.1825	0.1799	3	3
0.2236	0.1849	2	3
0.1902	0.1403	3	4

Legend: SD-Standard deviation

Table 4.14: Accuracy of Side Clearance of Stellite-tipped Saw-N and surface Smoothness of Sawn Lumber

SD(mm)		Surface Smoothness of Sawn Lumber	
Out	In	Out	In
0.1168	0.1300	3	5
0.1384	0.1476	4	4
0.1566	0.1616	4	3
0.2462	0.2038	2	2
0.2523	0.2859	2	2
0.2358	0.2591	2	2
0.2080	0.2130	2	2
0.1561	0.1636	4	3
0.1207	0.1145	5	5

Legend: SD-Standard deviation

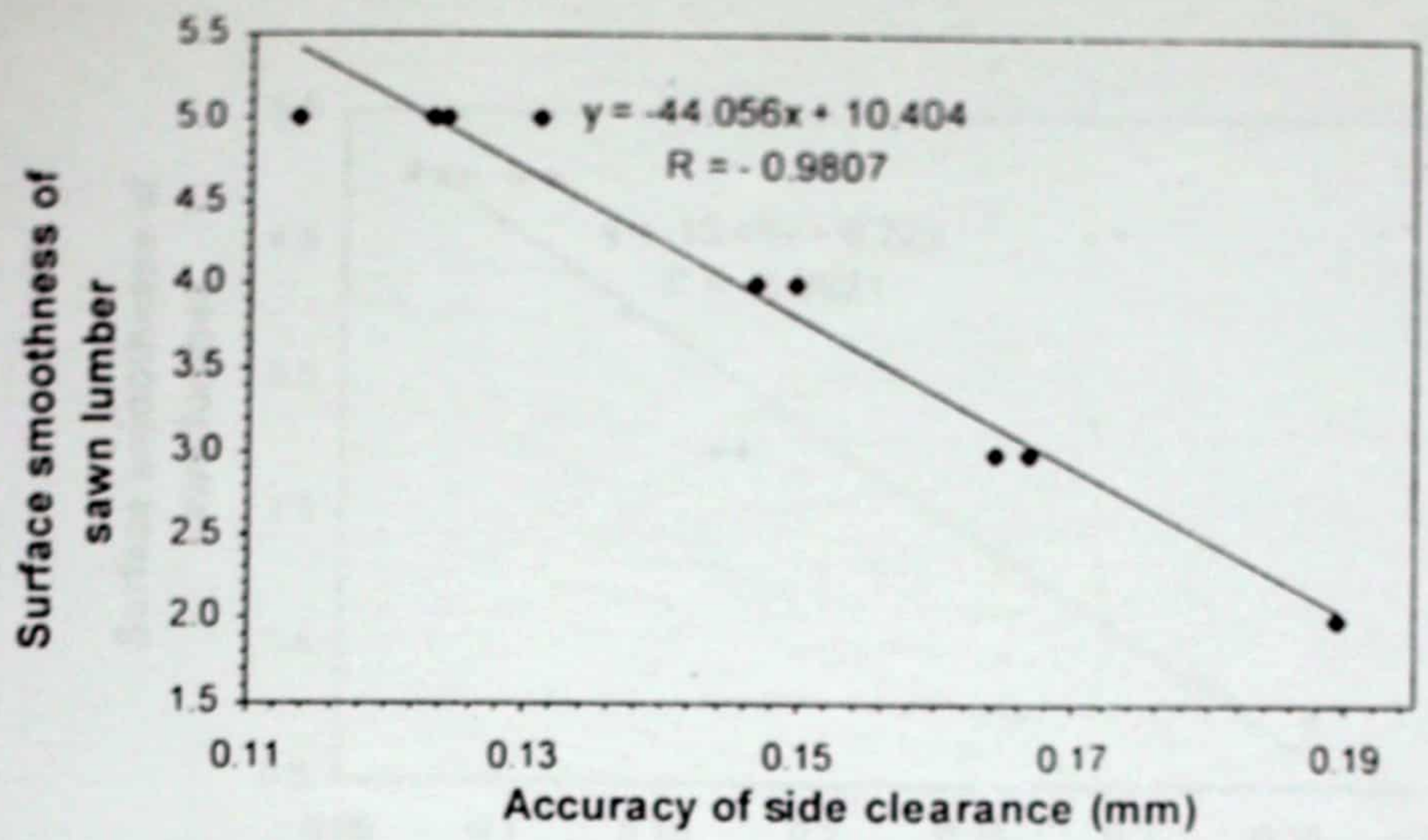


Figure 4.6a: Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (L-out)

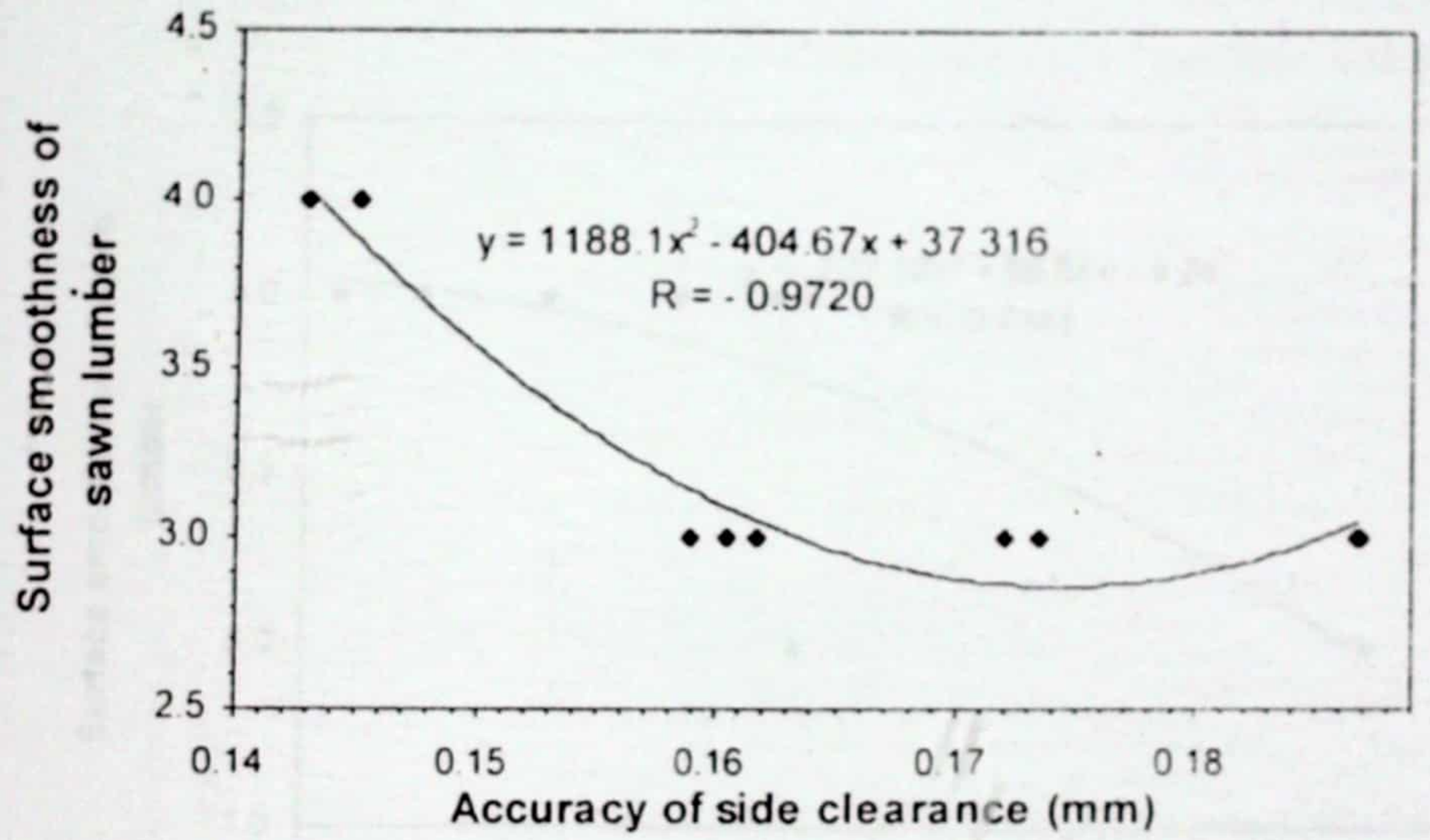


Figure 4.6b: Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (L-in)

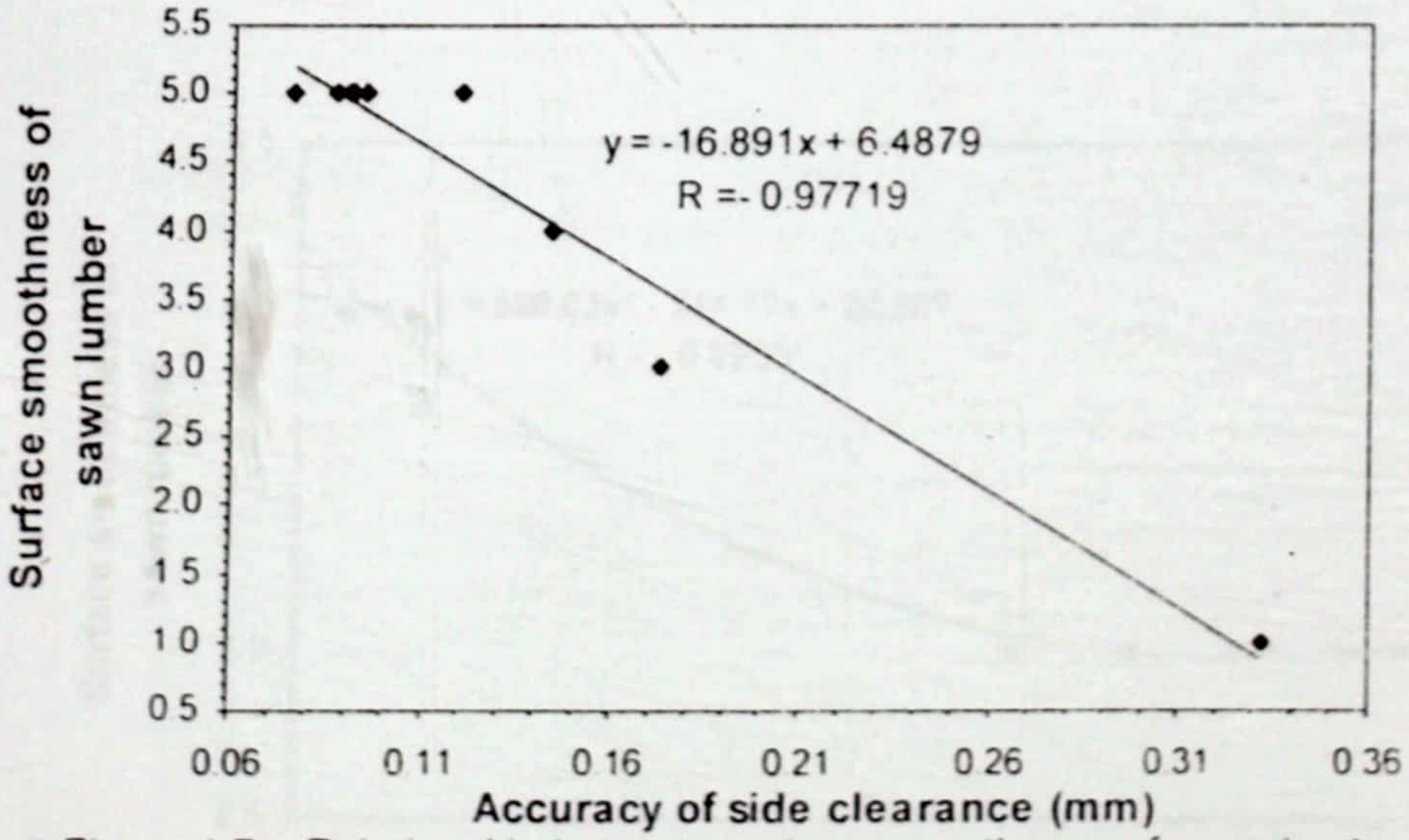


Figure 4.7a: Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (K-out)

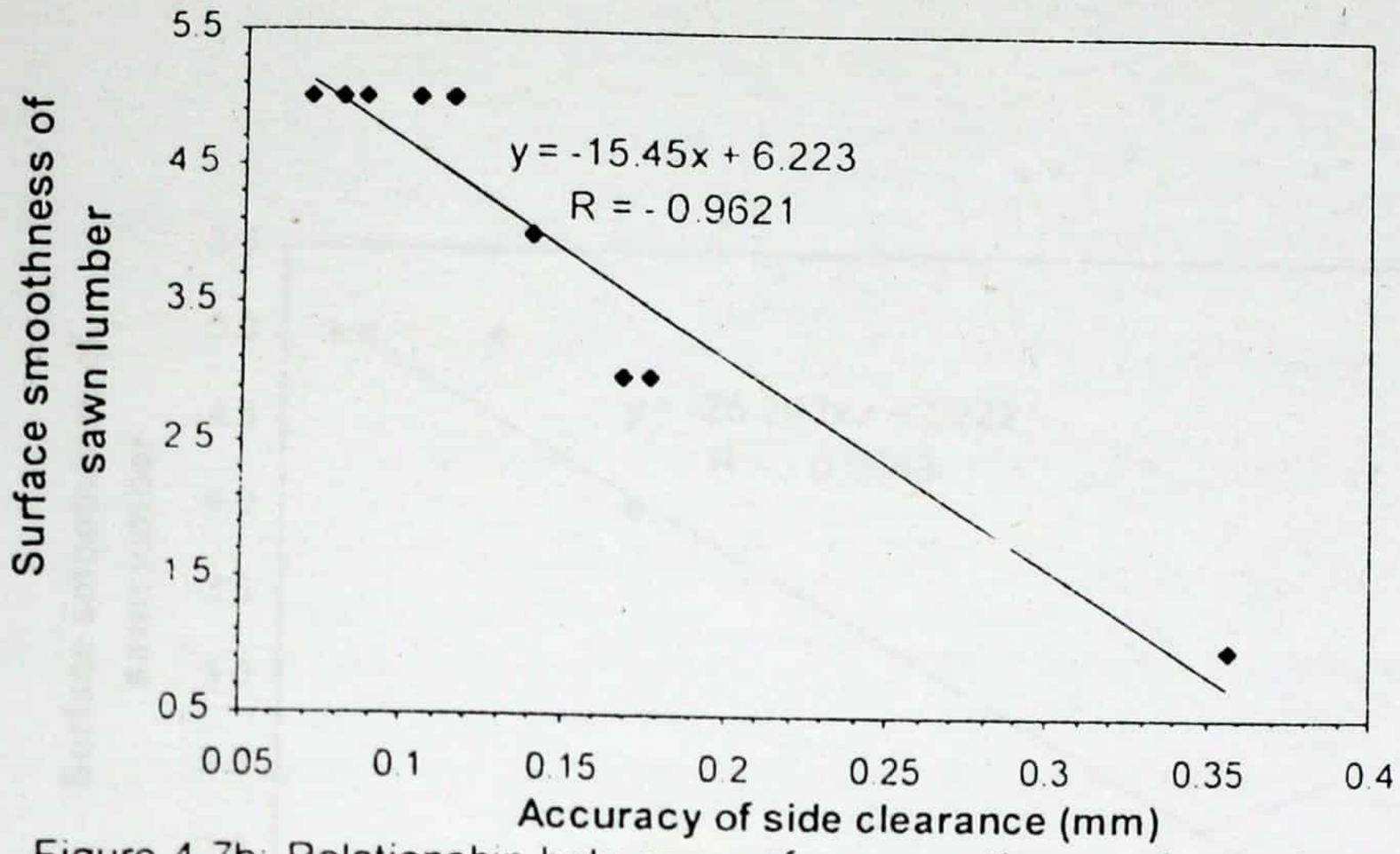


Figure 4.7b: Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (K-in)

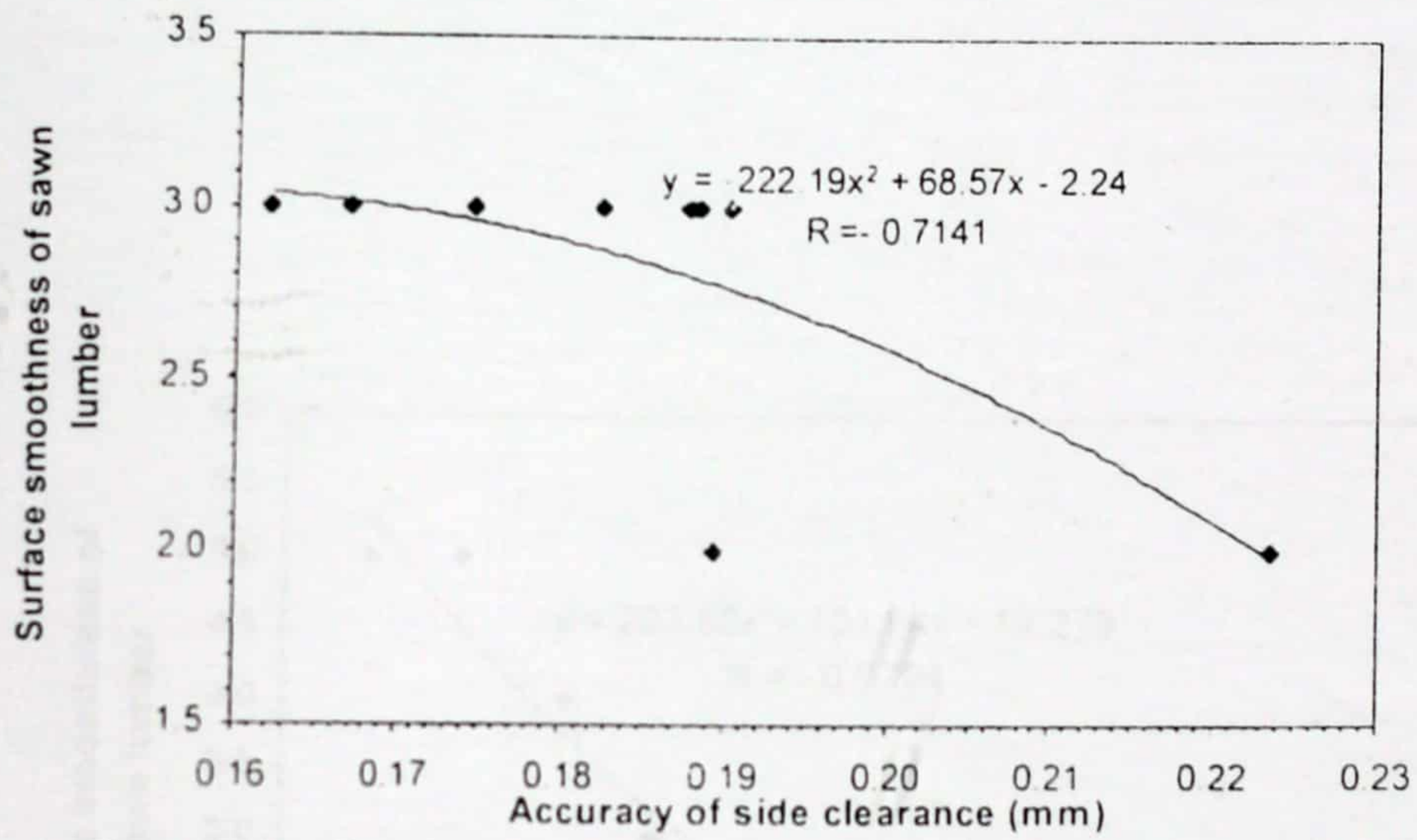


Figure 4.8a: Relationship beween surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (M-out)

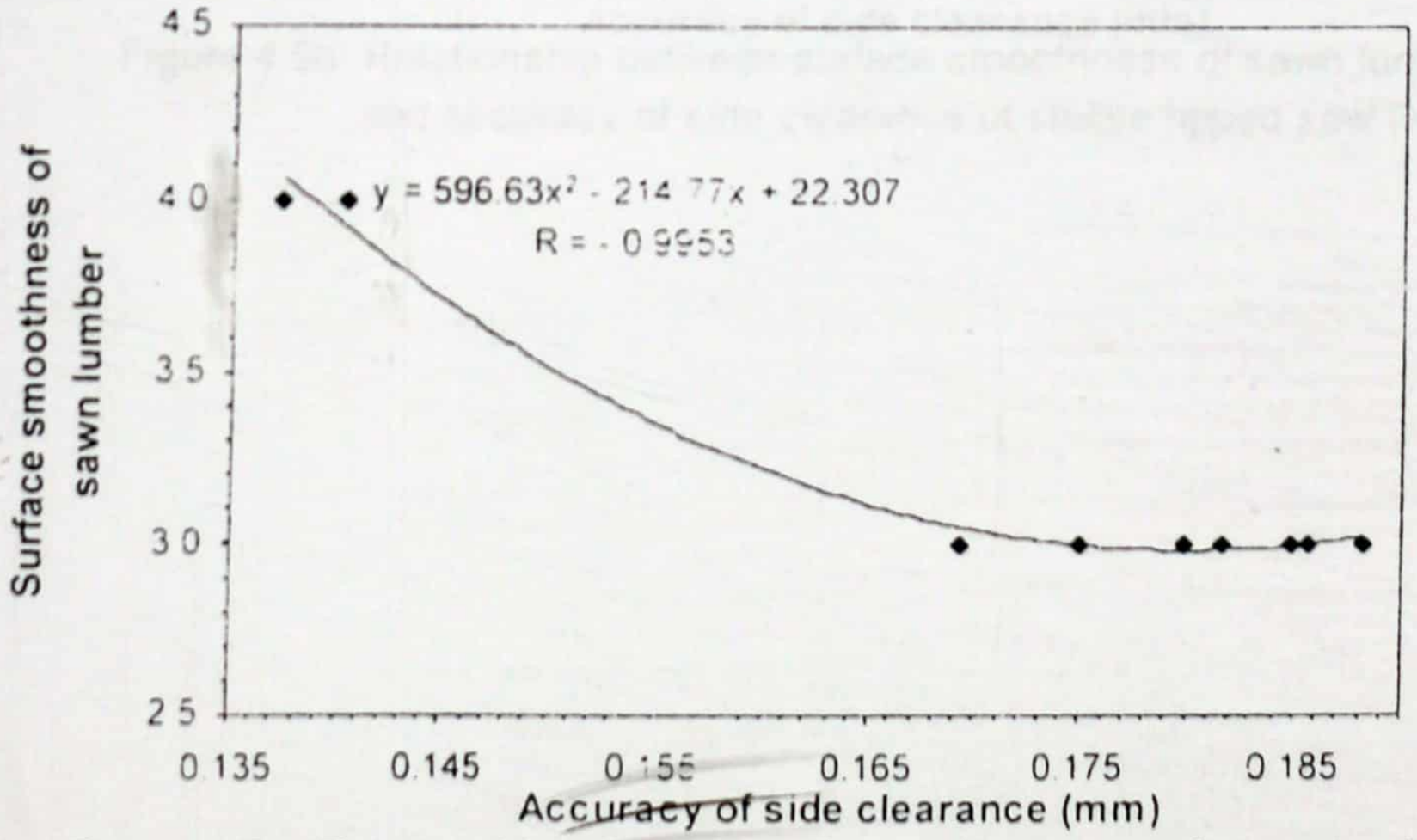


Figure 4.8b: Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (M-in)

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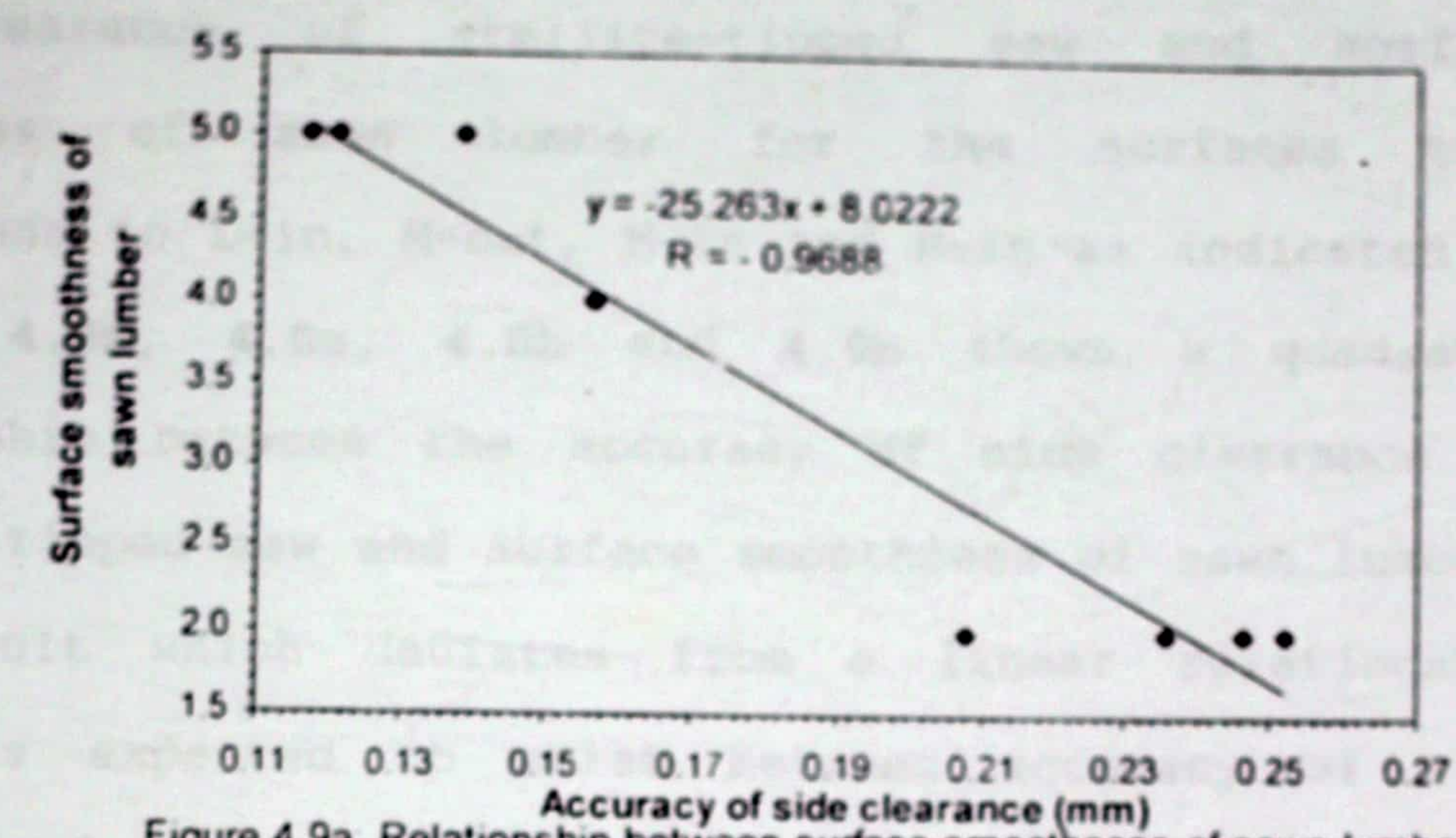


Figure 4.9a Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (N-out)

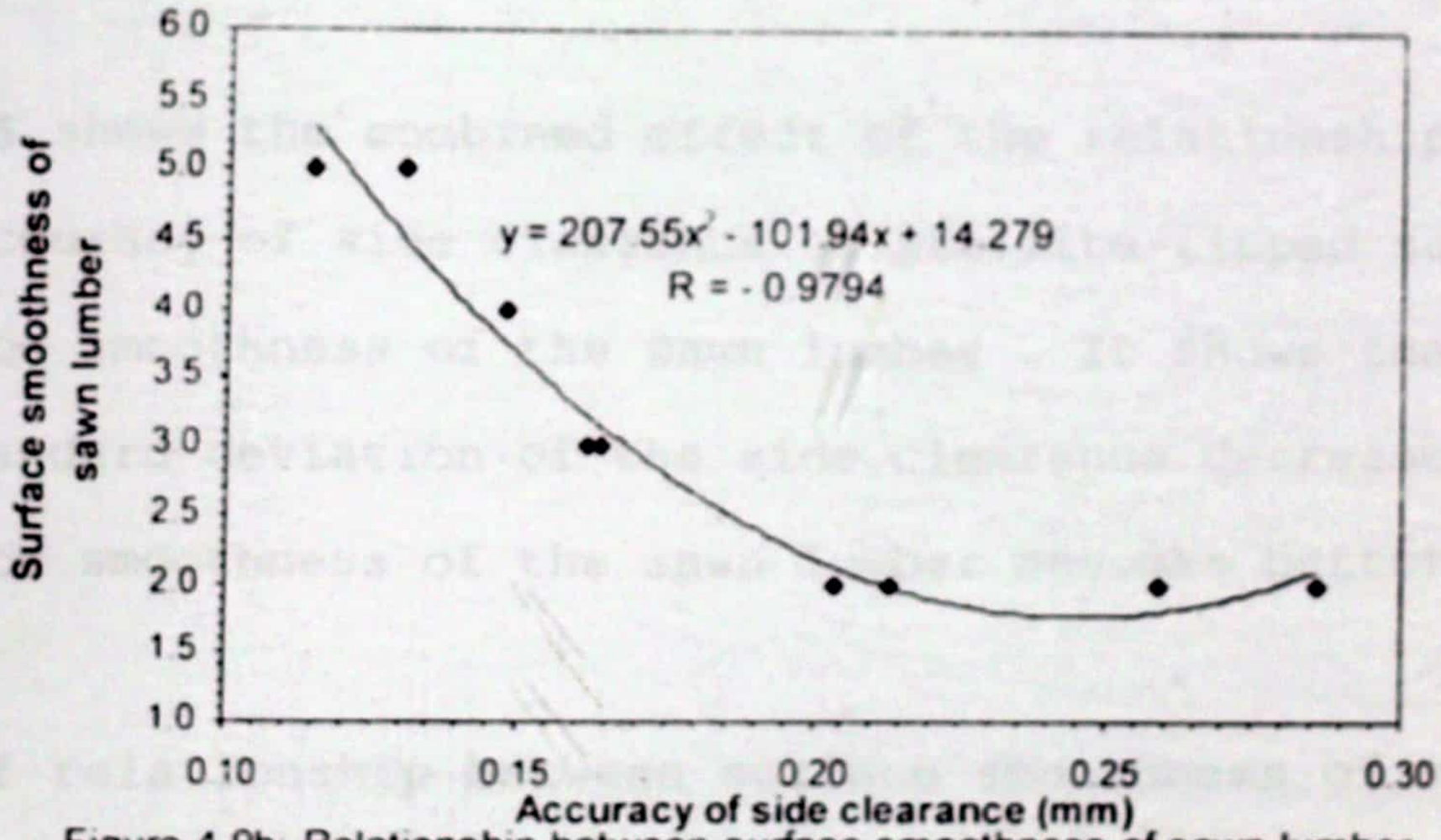


Figure 4.9b Relationship between surface smoothness of sawn lumber and accuracy of side clearance of stellite-tipped saw (N-in)

The graphs of the relationship between the accuracy of side clearance of stellite-tipped saw and surface smoothness of sawn lumber for the surfaces that corresponds to L-in, M-out, M-in and N-in as indicated by **Figures 4.6b, 4.8a, 4.8b** and **4.9b** shows a quadratic relationship between the accuracy of side clearance of stellite-tipped saw and surface smoothness of sawn lumber. This result which deviates from a linear relationship which was expected to exist between accuracy of side clearance of stellite-tipped saw and surface smoothness of sawn lumber may be due to the fact that the improvised surface which was used to determine the surface smoothness of sawn lumber could not measure small change in surface smoothness.

Table 4.15 shows the combined effect of the relationship between accuracy of side clearance of stellite-tipped saws and surface smoothness of the sawn lumber . It shows that as the standard deviation of the side clearance decreases the surface smoothness of the sawn lumber becomes better.

A graph of relationship between surface smoothness of sawn lumber and mean standard deviation of all the four stellite-tipped saws as indicated in **Figure 4.10** shows that on the average when the standard deviation of the side clearance is 0.1700mm or low the surface smoothness

Table 4.15: Surface Smoothness of Sawn Lumber and Mean Accuracy of Side Clearance of all the Four Saws

Surface Smoothness	Mean Standard deviation of side clearance (mm)				All the four saws
	Saw-K	Saw-L	Saw-M	Saw-N	
1	0.3443	-	-	-	0.3443
2	-	0.1893	0.2066	0.2380	0.2113
3	0.1723	0.1690	0.1798	0.1626	0.1704
4	0.1419	0.1399	0.1388	0.1500	0.1427
5	0.0921	0.1229	-	0.1205	0.1118

of the sawn lumber produced by the four saws could be classified as either good, very good or excellent. The graph also indicates that the surface smoothness of the sawn lumber was excellent when the standard deviation of the side clearance was 0.1120mm or low and was poor or very poor when the standard deviation of the side clearance was 0.2100mm or more.

Although surface smoothness of sawn lumber is also influenced by other factors such as the rake angle and the pitch size of the sawblade as indicated by Wood News (1993) that a large pitch i.e. lower number of teeth per 2.54cm (1 inch) will allow high feed speeds but will give a poorer surface and Uddeholm Strip Steel AB (1991) that a small amount of hook gives a smoother sawn surface than a large one, these two parameters were adequately selected

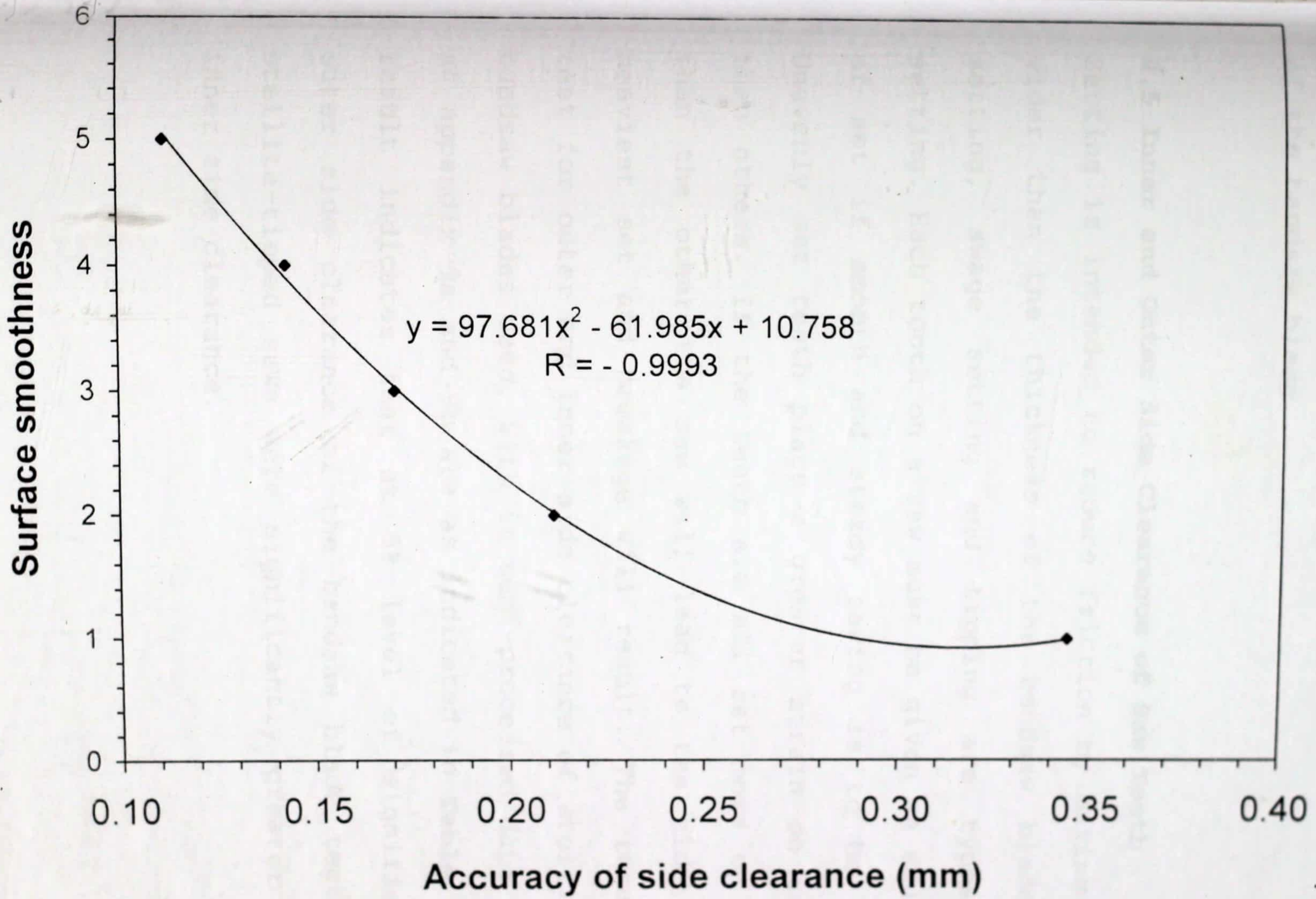


Figure 4.10: Relationship between surface smoothness of sawn lumber and mean standard deviation of all the four stellite-tipped saws

to play down their effect on the smoothness of the sawn surface hence the smoothness of the sawn board surface was influenced primarily by the accuracy of the side clearance of the bandsaw blade.

4.5 Inner and Outer Side Clearance of Saw Teeth

Setting is intended to reduce friction by making the kerf wider than the thickness of the bandsaw blade. Spring setting, swage setting and tipping are types of saw setting. Each tooth on a saw must be given an equal amount of set if smooth and steady sawing is to be obtained. Unevenly set teeth place a greater strain on some teeth than others. If the teeth are all set more on one side than the other the saw will lead to the side with the heaviest set and breakage will result. The result of T-test for outer and inner side clearance of stellite-tipped bandsaw blades used, with it semi-processed data indicated at appendix 9a and 9b are as indicated in **Table 4.16**. The result indicates that at 5% level of significance the outer side clearance of the bandsaw blade teeth of the stellite-tipped saws were significantly greater than the inner side clearance.

Table 4.16: T-test for Outer and Inner Side Clearance of Stellite-tipped Bandsaw Blades

Saw	df	Mean-out (mm)	Mean-in (mm)	T-stat	T-critical
K	8	0.7900	0.6794	2.4514	2.306
L	8	0.7364	0.6016	8.7957	2.306
M	8	0.9559	0.7073	10.3100	2.306
N	8	0.7492	0.7120	3.0572	2.306

Legend: df=Degrees of freedom

This may be attributed to the inability of the side dressing and side grinding machines to grind the saw teeth uniformly. It was observed that during the sharpening of the saws the grinding machine cut the tip of the saw tooth at an angle. This was largely due to the fact that the grinding machines were too old and for that matter are not able to perform efficiently. The grinding machine was not also firmly fixed on the ground.

4.6 Sawing Variation and Depth of Cut

The result of the relationship between sawing variation and depth of cut is as shown in **Table 4.17** with it semi-processed data indicated in **Appendix 14**. The result

Table 4.17: Depth of Cut and Sawing Variation of Sawn Lumber Thickness

Depth of Cut (cm)	Z	X (mm)	SD-wb (mm)	SD-bb (mm)	SD-t (mm)
80	10	42.79	1.5724	0.6567	1.7040
75	10	39.10	1.3891	0.5403	1.4905
61	10	41.92	1.0571	0.3821	1.1240
50	10	42.42	0.9840	0.4023	1.0631
42	10	42.48	0.7072	0.3780	0.8019
32	10	42.76	0.5898	0.3934	0.7090

Z = Number of Boards Sampled for each Sampling
X = Mean Thickness of Boards

indicates that as the depth of cut decreases the standard deviation within boards, the standard deviation between boards and the total standard deviation decreases. The values of the correlation coefficient as shown on graph of **Figure 4.11** also indicate a strong positive linear relationship between depth of cut and standard deviation within boards, standard deviation between boards and total standard deviation. This trend is due to the fact that for the same saw and technical set-up as the depth of cut increases, the sawing force required to saw the work piece increases. Thus the saw tends to snake through the work piece.

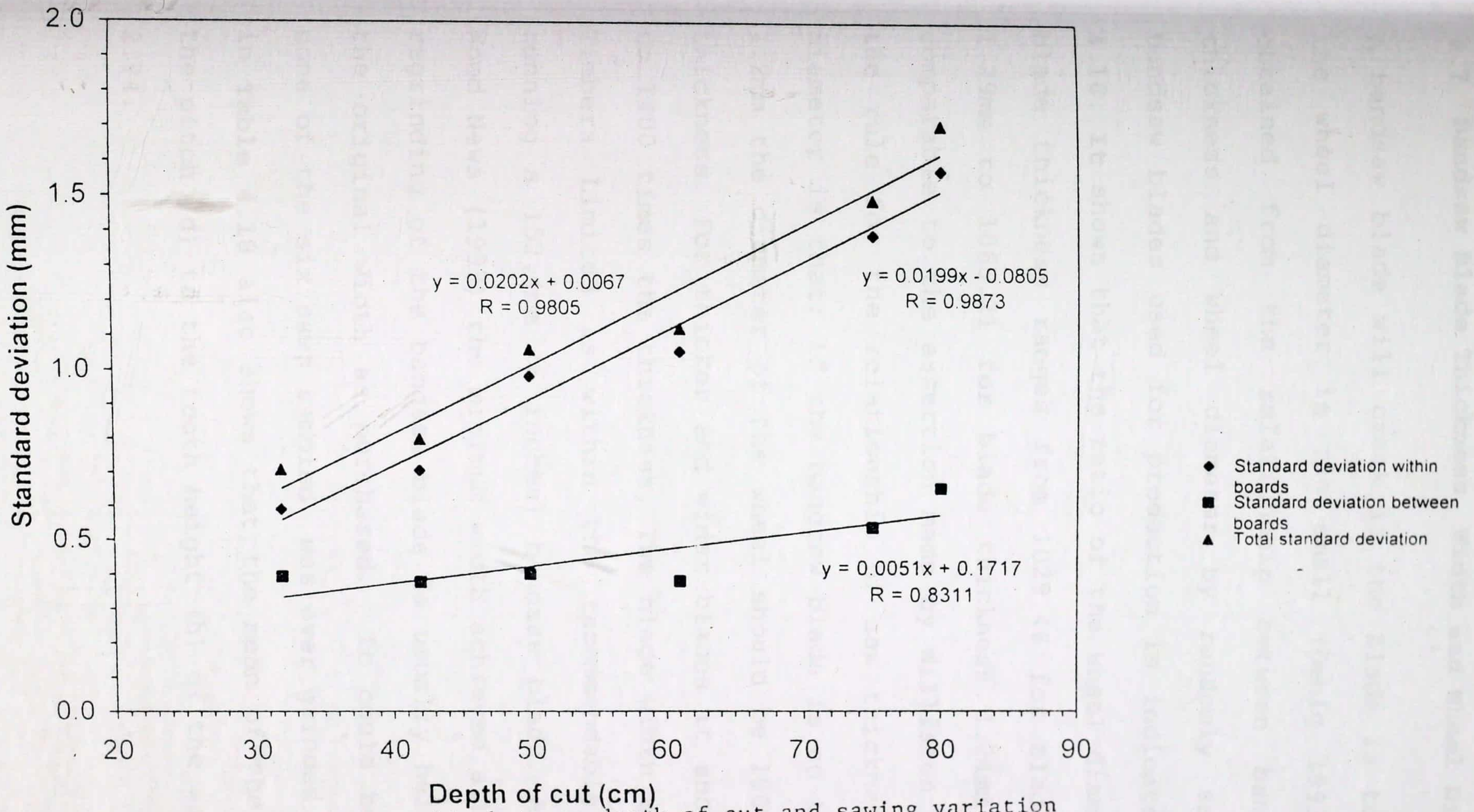


Figure 4.11: Relationship between depth of cut and sawing variation indicated by standard deviation of lumber thickness

4.7 Bandsaw Blade Thickness, Width and Wheel Diameter

A bandsaw blade will crack if the blade is too thick or the wheel diameter is too small (Denig 1993). Results obtained from the relationship between bandsaw blade thickness and wheel diameter by randomly sampling six bandsaw blades used for production is indicated in **Table 4.18. It** shows that the ratio of the wheel diameter to the blade thickness ranges from 1029.46 for blade thickness 1.29mm to 1065.21 for blade thickness 1.24mm. This is comparable to the assertion made by Williston (1988) that the rule for the relationship of saw thickness to wheel diameter is that; if the bandsaw blade is no thicker than 1.2mm the diameter of the wheel should be 1000 times its thickness. For thicker and wider blades it should be 1200 to 1400 times the thickness. The blade width used at FABI Timbers Limited is within the recommendable width for running a 152.4mm (6 inches) bandsaw blade. According to Wood News (1993) the minimum width achieved after constant regrinding of the bandsaw blade is usually held at 35% of the original width as purchased. It could be said that none of the six saws sampled was over grinded. The result in **Table 4.18** also shows that the mean of the ratios of the pitch (d) to the tooth height (h) of the saws used was 2.74.

Table 4.18 Saw Blade Thickness, Width and Wheel Diameter

Wheel Diameter WD (mm)	Sawblade Thickness BT (mm)	Sawblade Width (mm)	Pitch d(mm)	Tooth Height h(mm)	WD/BT	d/h
1328	1.29	152.30	45.00	16	1029.46	2.81
1328	1.28	152.10	45.00	16	1037.50	2.82
1328	1.25	130.00	46.00	17	1059.60	2.71
1328	1.27	147.93	44.45	16	1042.96	2.78
1328	1.25	125.80	45.15	18	1062.40	2.51
1328	1.24	123.70	44.90	16	1065.21	2.81

Statistical analysis of d/h as indicated in **Table 19** shows that at 5% level of significance this value i.e. 2.74 is significantly less than that recommended by Wood News (1993), which is 3. Wood News (1993) recommended that the ratio of pitch to tooth height, appropriate for the sawing of hardwood using a saw with pitch up to 50mm is 3.0.

Table 4.19: T-test for Ratio of Pitch to Tooth Height (d/h)

Standard Value of d/h	Mean of d/h	T-test	T-Critical 5%
3	2.7	5.322	2.571

Legend :d/h = Ratio of pitch to tooth height

4.8 Quality Control

The objective of a statistical process control of quality is to achieve a process that is stable, predictable and capable to deliver products that meet the requirements of the customers almost all the time. The results of boards sampled from the production stream is as indicated in Appendix 15. The statistical control chart of the results as shown in **Figure 4.12** indicates that the mean thickness of the sawn boards was 42.42mm. The upper control limit (LCL) at 1.65 standard deviation was 44.08mm and the lower

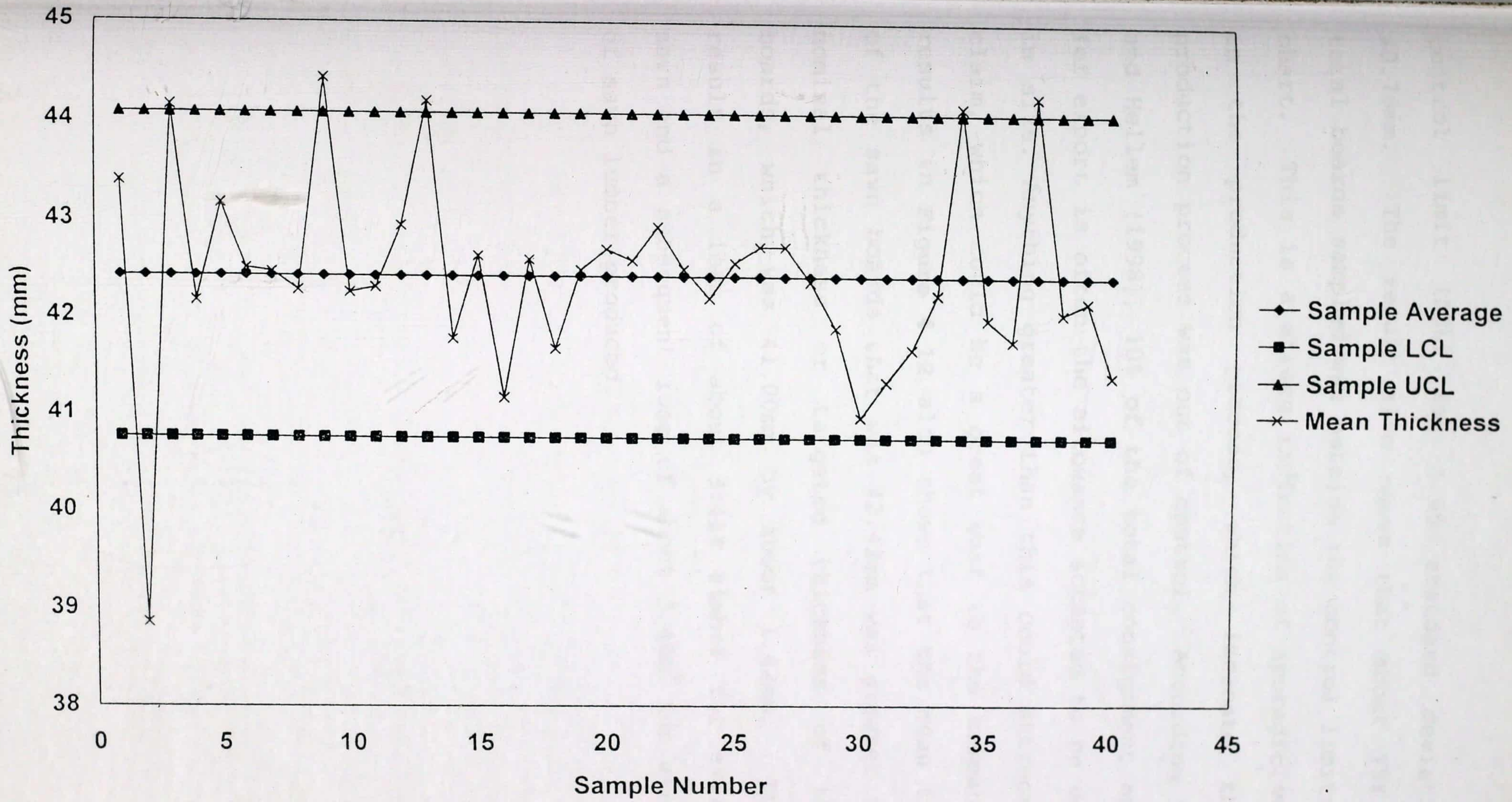


Figure 4.12: Statistical Process Control Chart for Thicknesses of 40 Samples of Sawn Lumber.

control limit (LCL) for 1.65 standard deviation was 40.76mm. The result also shows that about 15% of the total boards sampled was outside the control limits of the chart. This is a strong indication of sporadic variation in the production process, which indicate that the production process was out of control. According to Sagoe and Hellem (1998), 10% of the total consignment of lumber for export is often the allowance accepted to be defective in size. Anything greater than this could attract export claim, which could be a great cost to the company. The results in **Figure 4.12** also shows that the mean thickness of the sawn boards that was 42.42mm was greater than the nominal thickness or targeted thickness of the sawn boards, which was 41.00mm by about 1.42mm. This will result in a loss of about 3.41% timber for every board sawn and a subsequent loss of about 3.46m^3 for every 100m^3 of sawn lumber produced.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

In the conversion of logs into lumber variation in the set works together with the wearing and the use of wrong specification of bandsaw blades introduce significant departures of board thickness from the predetermined thickness as well as production of lumber with poor surface quality. When this happens, valuable amounts of wood are lost.

This thesis was geared toward investigating into the performance of bandsaw blade in sawing Wawa(*Triplochiton Scleroxylum*) at Fabi Timbers Limited. Under this the researcher considered the kerf accuracy of bandsaw blades, the thickness variation of sawn lumber, the relationship between side clearance and sawing accuracy of sawn lumber as well as the relationship between depth of cut and sawing variation.

The results of this work shows that the mean kerf width of the stellite-tipped saw which was 4.2mm was significantly greater than that of swage-set saw of the same type which was 3.06mm. The accuracy of kerf width for stellite-tipped saw was found to be almost the same as that of the swage-set saw even though the swage-set saws were found to have

poorer accuracy of kerf width. This was due to the crude method used by the saw doctors to shape the tooth kerf after swage-set.

The results indicate that the thickness variation of the sawn lumber was due to bigger kerf width of the saw blade. A quadratic relationship between side clearance and sawing variation was established. As the side clearance increased the sawing variation also increased until an average minimum values of 0.42mm, 0.33mm and 0.59mm standard deviation *within boards,* standard deviation between boards and total standard deviation respectively were obtained for an optimal side clearance value of 0.69mm. There after the sawing variation began to increase with increasing side clearance. It was also established that between a maximum side clearance value of 0.8319mm, which occurred for stellite-M, and a minimum side clearance value of 0.4335mm, which occurred for stellite-N, the sawing variation was generally low having an average value of 0.3147mm.

The result also revealed a quadratic relationship between the accuracy of side clearance and the surface smoothness of sawn lumber. It was observed that on the average the surface smoothness of the sawn lumber was good, very good

or excellent when the standard deviation of the side clearance was 0.1700mm or low. It was also established that on the average the surface smoothness of the sawn lumber was excellent when the standard deviation of the side clearance was 0.1120mm or low and was poor or very poor when the standard deviation of the side clearance was 0.2100mm or more. The outer side clearance of stellite-tipped saw was also noted to be significantly bigger than their corresponding inner side clearance. This can cause the sawblade to lead to the side with the heaviest set and result in breakage.

Thickness variation of sawn lumber was also found to have a very strong positive correlation with depth of cut. In order words, sawing variation increased as the depth of cut increased. This was due to greater force required to saw bigger logs. The work also indicated that the ratio of the wheel diameter to the sawblade thickness used at the mill, which ranges from 1029.46 for bandsaw blade thickness 1.29mm to 1065.21 for bandsaw blade thickness 1.24mm was adequate. However the ratio of the tooth pitch to the tooth height, which was 2.74 on the average, was significantly less than the recommended value of three.

Lastly samples of boards taken from the production stream revealed that lumber production was out of control. The

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mean thickness of the boards of Wawa (*Triplochiton scleroxylon*) sampled, which was 42.42mm, was about 3.46% thicker than the targeted thickness which was 41mm. This situation result in a loss of 3.46m^3 of lumber for every 100m^3 of lumber produced and for that matter a great financial loss of revenue to the company.

5.2 Recommendations

1. This work has revealed that the use of wrong bandsaw blade kerf width is one of the major contributing factors to the sawing inaccuracies in the sawmill industry. It is therefore recommended that saw doctors should be well trained to enable them to blend theory with practice in order to enhance their performance.
2. Research work must also be done to obtain the optimum side clearance angle of bandsaw blade for other local timber species to improve sawmill efficiency.
3. Sawmills must also be encouraged to use automatic stellite-tipping machines, which ensure higher precision and efficiency during tipping of bandsaw blades.
4. Sawmills in Ghana should also be encouraged to acquire modern machines for wood processing instead of the continuous use of obsolete machines which results in production inefficiencies.

REFERENCES

Brown, T.D. 1982. Quality Control in Lumber Manufacturing. Miller Freeman Publication Inc. S. Francisco. 12-25pp

Brindley, R. 1982. The Sawmill Improvement Programme: An Opportunity for Improved Recovery. Proceedings of Manufacturing lumber for Small Logs. University of Washington College of Forest Resources. Seattle Washington 44: 47-48pp.

Coleman, H and G. Amankwa2h 1998. The Current Status and Future Challenges of the Development and Marketing of Timber Product - the Ghana Example 26th IFSS, IRNR Library UST Kumasi. 1-36pp.

Crosby, P.B. 1985. Quality without Tears. The Art of Hassle-Free Management Mcgraw-Hill N.Y. 5-60pp.

Dening, W.E. 1982. Out of crisis: Quality Production and Competitive Position. Cambridge University Press Cambridge. 2-42pp.

Denig, J. 1993. Small Sawmill Handbook. Miller Freeman Inc., San Francisco. US 73-95pp.

FAO, 1985. Sawdoctoring Manual. Forestry Paper No. 58, FAO Rome. 63-88pp

LIBRARY
KWAME NKRUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY
KUMASI-GHANA

Frimpong-Mensah, K and L. Nagoda, 1994. Sawmilling and Machining. A Compendium Prepared for the Institute of Renewable Natural Resources UST. Kumasi, Ghana 12-75pp.

F.P.I.B 1995. Welcome to Forest Products Inspection Bureau 4th Edition, Annual Report, FPIB, Takoradi 1-14pp.

Gallant, M.N. 1958. Report to the Government of Ghana on Prospect of Development of Forest Industry. FAO of UN ROme Report No. 863. 29-31pp.

Kollmann, F.F.P. and W.A. Cote Jr. 1968. Principles of Wood Science and Technology Vol. I. Springer-Velag, Berlin. Hielberg. N.Y. 475-508pp

Kohji M, Nishimura, k and Y Ikami , 1993. Journal of the Japan Wood Research Society. Tokyo Vol. 39, No. 11. 1231-1238pp.

Lemaster R.L. 1986. Proceedings of the Eight Wood Machining Seminar. Forest Products Laboratory. University of California Berkeley. 10-30pp.

Martyr, N.R. 1973. Introduction to Sawmilling. Timber Research and Development Association, Hughenden, Valley, High Wycombe, Bucks HP14 4ND. Teaching Aid No. 8. 1-10pp.

Ministry of Lands and Forestry, 1996. Forestry Development Master Plan 1996-2020. MLF, Classified Document, Accra, Ghana.

Okai, R. 1999. Technology Auditing of Wood Processing Industries in Sub-Saharan Africa.14th International Wood Machining Seminar. Paris, Epinal, Cluny-France 709-719pp.

Pichulo , 1974. Modern Sawmill Techniques. Miller and Freeman Publications Vol. 4 125-143pp

Sagoe, J.A. and S, Hellem. 1998. Tolerance on green lumber Dimension for Selected Tropical Timber of Ghana. T.E.D.B. Report, Ghana.2-10pp

Telford, C.J. 1958. Small Sawmill Operators Manual. Agricultural Handbook No. 27 U.S. Department of Agriculture-Forest Service. 61-62pp.

TRADA. 1973. A Guide to the Use of the Saws and Cutters. Hughenden Valley, HighWyCombe, Buckinghamshire, HP144ND, England. Information Bulletin I/1B/18 21-33pp.

Uddeholm Strip Steel AB. 1991. Wood Bandsaw Blade Manual Second Edition. Uddeholm Strip Steel A.B. S-68401 Munkfors Sweden. 5-40pp.

Uddeholm Strip Steel AB 1989. Wood Bandsaw Blade Manual. First Edition. Uddeholm Strip Steel AB, S-68401. Munkfors, Sweden 10-59pp.

Williston, E.D.M 1988. Lumber Manufacturing: The Design and Operation of Sawmills and Planner Mills. Miller Freeman Publication. Inc. USA 95-100pp.

Wood News. 1993. Bandsaw Blades: Criteria for Selection and Use. Wood News Vol.2(4). 44-53pp.

World Wood. 1975. European Sawmill Techniques. Proceedings from the First International Sawmill Seminar. Munich, 20-22 June in Conjunction with Inter Forest 10-118pp.

Appendix 1a: Kerf Width (mm) of Stellite-Tipped Saw 1

Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)	Tooth No	Saw kerf (mm)
1	3.48	31	3.77	61	4.07	91	4.29	121	4.07	151	3.81	181	3.83		
2	4.07	32	4.33	62	4.00	92	4.68	122	3.90	152	3.92	182	4.33		
3	4.15	33	3.79	63	4.37	93	3.78	123	3.51	153	3.73	183	4.02		
4	4.23	34	4.04	64	4.10	94	4.15	124	3.51	154	3.93	184	3.92		
5	3.88	35	3.92	65	4.01	95	4.22	125	3.91	155	3.61	185	4.23		
6	4.46	36	3.88	66	4.07	96	4.13	126	3.65	156	4.07	186	3.97		
7	3.79	37	4.04	67	4.10	97	4.11	127	4.08	157	4.08	187	4.37		
8	4.09	38	3.90	68	4.17	98	3.87	128	3.83	158	4.04	188	4.19		
9	3.81	39	3.91	69	4.14	99	4.26	129	3.96	159	3.91	189	4.27		
10	4.04	40	4.07	70	4.05	100	4.30	130	3.48	160	1.44	190	4.50		
11	4.00	41	4.13	71	4.11	101	4.23	131	3.81	161	3.92	191	4.12		
12	3.86	42	3.98	72	4.40	102	4.11	132	3.51	162	3.74	192	4.13		
13	3.86	43	4.01	73	4.31	103	4.01	133	4.09	163	4.07	193	4.11		
14	3.86	44	4.47	74	4.08	104	4.25	134	3.97	164	4.04	194	4.11		
15	3.77	45	3.83	75	3.95	105	4.12	135	3.94	165	4.08	195	4.12		
16	3.92	46	4.11	76	4.05	106	4.09	136	3.82	166	3.82	196	4.29		
17	3.71	47	4.07	77	4.19	107	4.30	137	4.00	167	3.70	197	4.14		
18	3.84	48	3.96	78	4.35	108	4.13	138	4.45	168	4.14	198	4.35		
19	3.53	49	4.22	79	4.07	109	4.25	139	3.65	169	4.07	199	4.23		
20	3.96	50	4.23	80	4.20	110	4.18	140	3.78	170	3.70	200	4.00		
21	3.82	51	4.36	81	4.27	111	4.06	141	4.00	171	4.09	201	4.29		
22	3.73	52	3.79	82	4.20	112	3.97	142	3.96	172	3.88	202	4.25		
23	3.88	53	4.42	83	4.01	113	4.20	143	3.82	173	3.85	203	4.15		
24	4.07	54	3.90	84	4.01	114	4.02	144	4.01	174	4.16	204	4.11		
25	3.90	55	4.30	85	4.21	115	4.47	145	4.07	175	3.92	205	3.97		
26	4.10	56	4.10	86	3.95	116	3.73	146	4.44	176	4.02	206	3.85		
27	4.02	57	4.06	87	4.33	117	4.20	147	3.92	177	3.85	207	3.51		
28	3.92	58	3.86	88	4.20	118	4.40	148	4.06	178	4.00	208	4.03		
29	3.97	59	4.39	89	4.54	119	4.11	149	4.03	179	3.88	209	4.24		
30	3.78	60	3.89	90	3.82	120	4.00	150	4.17	180	3.81				

Appendix 1b: Kerf Width (mm) of Stellite-Tipped Saw 2

Tooth No	Saw Kerf (mm)	Tooth No.	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No.	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No.	Saw Kerf (mm)
1	4.33	31	4.51	61	4.73	91	4.51	121	4.56	151	4.08	181	4.52		
2	4.43	32	4.53	62	4.45	92	4.60	122	4.48	152	4.64	182	4.60		
3	4.54	33	4.49	63	4.61	93	4.50	123	4.42	153	4.99	183	4.42		
4	4.51	34	4.47	64	4.79	94	4.60	124	4.52	154	4.80	184	4.72		
5	4.59	35	4.56	65	4.75	95	4.71	125	4.59	155	4.82	185	4.46		
6	4.49	36	4.51	66	4.65	96	4.51	126	4.30	156	4.88	186	3.88		
7	4.52	37	4.61	67	4.69	97	4.48	127	4.88	157	4.70	187	3.79		
8	4.60	38	4.69	68	4.68	98	4.40	128	4.80	158	4.83	188	4.36		
9	4.48	39	4.59	69	4.49	99	4.49	129	4.70	159	4.73	189	4.19		
10	4.54	40	4.67	70	4.65	100	4.50	130	4.68	160	4.52	190	4.33		
11	4.53	41	4.67	71	4.56	101	4.56	131	4.75	161	4.57	191	4.70		
12	4.71	42	4.66	72	4.04	102	4.55	132	4.34	162	4.53	192	4.70		
13	4.64	43	4.61	73	4.27	103	4.44	133	4.65	163	4.53	193	4.31		
14	4.63	44	4.52	74	4.70	104	4.45	134	4.70	164	4.82	194	4.58		
15	4.69	45	4.25	75	4.25	105	4.57	135	4.31	165	4.66	195	4.02		
16	4.72	46	4.27	76	4.44	106	4.51	136	3.98	166	4.66	196	4.47		
17	4.73	47	4.18	77	4.58	107	4.35	137	4.59	167	4.64	197	4.61		
18	4.24	48	3.93	78	4.20	108	4.42	138	4.19	168	4.78	198	4.69		
19	4.64	49	4.34	79	4.08	109	4.35	139	4.44	169	4.70	199	4.90		
20	4.21	50	4.56	80	4.14	110	4.42	140	4.19	170	4.43	200	4.63		
21	4.37	51	4.45	81	4.33	111	4.48	141	4.52	171	4.41	201	4.49		
22	4.52	52	4.18	82	4.30	112	4.62	142	4.26	172	4.35	202	4.23		
23	4.72	53	4.65	83	3.92	113	4.43	143	4.28	173	4.62	203	4.34		
24	4.49	54	4.18	84	3.83	114	4.45	144	4.52	174	4.70	204	4.67		
25	4.57	55	4.33	85	3.79	115	4.47	145	4.48	175	4.33	205	4.64		
26	4.34	56	4.24	86	3.79	116	4.48	146	4.52	176	4.56	206	4.45		
27	4.43	57	4.38	87	4.26	117	4.48	147	4.57	177	4.45	207	4.47		
28	4.37	58	4.47	88	4.30	118	4.52	148	4.20	178	4.52	208	4.45		
29	4.81	59	4.46	89	4.00	119	4.52	149	4.57	179	3.96	209	4.41		
30	4.78	60	4.25	90	4.46	120	4.49	150	4.67	180	3.82				

Appendix 1c: Kerf Width (mm) of Stellite-Tipped Saw 3

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	4.79	31	3.99	61	4.22	91	4.25	121	4.07	151	3.82	181	4.39		
2	4.14	32	4.20	62	3.73	92	4.31	122	4.29	152	4.31	182	4.02		
3	4.06	33	4.39	63	3.59	93	4.35	123	4.40	153	4.40	183	4.07		
4	3.76	34	4.52	64	4.40	94	4.81	124	4.02	154	4.21	184	3.88		
5	4.10	35	4.13	65	3.63	95	4.54	125	4.18	155	4.14	185	4.08		
6	4.23	36	4.06	66	4.14	96	4.46	126	4.06	156	3.54	186	4.06		
7	3.99	37	4.39	67	4.06	97	3.94	127	4.32	157	4.08	187	4.06		
8	4.29	38	4.27	68	4.24	98	4.24	128	3.95	158	4.29	188	4.36		
9	4.28	39	4.43	69	3.77	99	4.06	129	4.40	159	4.41	189	4.07		
10	4.00	40	4.08	70	3.82	100	4.59	130	4.99	160	4.10	190	4.81		
11	4.14	41	4.06	71	3.99	101	4.14	131	4.24	161	4.80	191	4.29		
12	4.08	42	4.89	72	4.38	102	4.23	132	4.41	162	4.88	192	4.50		
13	4.24	43	4.06	73	4.28	103	4.26	133	4.55	163	4.38	193	4.25		
14	4.28	44	4.17	74	4.59	104	3.58	134	4.14	164	3.89	194	4.52		
15	4.24	45	4.08	75	4.39	105	4.22	135	4.14	165	4.13	195	4.51		
16	4.26	46	4.49	76	4.76	106	4.36	136	4.53	166	4.54	196	4.10		
17	4.08	47	4.39	77	4.16	107	3.65	137	4.71	167	3.84	197	4.12		
18	4.13	48	4.52	78	4.56	108	4.21	138	4.36	168	4.51	198	4.33		
19	4.17	49	4.17	79	3.71	109	4.17	139	4.10	169	4.28	199	4.24		
20	4.41	50	4.43	80	4.77	110	4.44	140	4.21	170	4.26	200	4.11		
21	4.44	51	4.32	81	4.25	111	3.95	141	4.01	171	3.80	201	4.37		
22	4.40	52	4.33	82	4.48	112	3.18	142	4.34	172	4.00	202	3.86		
23	4.30	53	4.39	83	4.05	113	4.13	143	4.51	173	4.17	203	4.26		
24	4.61	54	4.60	84	4.05	114	4.18	144	4.42	174	4.28	204	3.99		
25	4.33	55	5.08	85	4.48	115	3.88	145	4.46	175	4.38	205	4.27		
26	4.30	56	4.41	86	4.34	116	3.83	146	4.42	176	4.51	206	4.14		
27	4.52	57	4.41	87	4.34	117	3.68	147	4.56	177	4.81	207	4.14		
28	4.43	58	4.12	88	4.44	118	3.62	148	4.33	178	4.09	208	4.44		
29	4.08	59	4.72	89	4.39	119	3.61	149	4.57	179	4.34	209	4.46		
30	4.29	60	4.54	90	4.37	120	3.72	150	4.54	180	4.16				

Appendix 1d: Kerf Width (mm) of Stellite-Tipped Saw 4

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	4.10	31	4.05	61	4.10	91	4.10	121	4.00	151	3.85	181	4.25		
2	4.00	32	4.15	62	3.75	92	4.10	122	3.90	152	4.05	182	4.10		
3	3.75	33	4.00	63	4.20	93	3.90	123	3.90	153	4.05	183	4.10		
4	3.85	34	4.10	64	3.70	94	3.85	124	3.95	154	4.00	184	4.00		
5	3.80	35	4.15	65	3.95	95	3.95	125	3.80	155	4.05	185	4.15		
6	3.45	36	4.20	66	3.95	96	3.65	126	4.05	156	4.05	186	4.15		
7	3.75	37	4.00	67	4.10	97	3.75	127	4.15	157	4.05	187	4.10		
8	4.05	38	4.15	68	3.90	98	4.20	128	4.10	158	4.25	188	3.90		
9	4.10	39	4.20	69	4.00	99	4.45	129	4.05	159	4.00	189	4.20		
10	3.95	40	3.85	70	4.00	100	4.00	130	4.05	160	4.15	190	3.95		
11	4.05	41	4.10	71	3.95	101	4.20	131	4.05	161	4.25	191	4.00		
12	4.05	42	4.15	72	4.05	102	4.15	132	4.10	162	4.30	192	4.20		
13	4.10	43	4.10	73	4.15	103	4.20	133	3.90	163	3.95	193	3.85		
14	4.05	44	4.05	74	4.05	104	4.05	134	4.15	164	4.05	194	4.05		
15	4.15	45	4.10	75	4.05	105	4.00	135	4.10	165	3.95	195	3.75		
16	4.05	46	4.10	76	3.95	106	3.55	136	3.80	166	4.00	196	4.00		
17	3.90	47	3.65	77	4.10	107	4.05	137	4.10	167	4.05	197	3.80		
18	3.95	48	4.20	78	3.85	108	4.05	138	3.95	168	4.05	198	3.80		
19	4.10	49	4.25	79	4.00	109	4.25	139	4.10	169	4.20	199	3.85		
20	4.10	50	4.05	80	4.00	110	3.95	140	3.95	170	4.00	200	3.80		
21	4.05	51	4.40	81	4.15	111	4.25	141	4.10	171	4.20	201	4.00		
22	4.00	52	3.95	82	4.20	112	4.45	142	4.30	172	3.65	202	4.15		
23	4.15	53	4.15	83	4.15	113	4.15	143	4.15	173	4.10	203	4.20		
24	4.10	54	4.15	84	3.90	114	4.25	144	4.15	174	4.20	204	4.05		
25	4.35	55	4.10	85	4.10	115	4.35	145	3.95	175	4.10	205	4.20		
26	4.10	56	4.15	86	4.20	116	4.05	146	4.15	176	4.10	206	3.85		
27	3.95	57	3.95	87	4.00	117	4.15	147	4.20	177	4.10	207	3.90		
28	4.00	58	4.10	88	4.15	118	4.30	148	4.00	178	3.95	208	4.20		
29	3.85	59	3.95	89	4.10	119	4.15	149	3.90	179	4.05	209	4.10		
30	3.85	60	4.15	90	4.00	120	4.10	150	4.15	180	4.00				

Appendix 2a: Kerf Width (mm) of Swage-Set Saw 1

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	2.34	31	3.11	61	3.09	91	2.78	121	3.48	151	3.01	181	3.55		
2	2.51	32	3.14	62	3.24	92	3.59	122	3.41	152	2.76	182	2.88		
3	2.80	33	3.13	63	3.28	93	3.48	123	3.10	153	2.77	183	3.55		
4	3.02	34	3.25	64	3.38	94	3.47	124	3.07	154	2.77	184	3.39		
5	3.15	35	3.10	65	3.28	95	3.64	125	2.92	155	4.02	185	3.67		
6	2.64	36	3.15	66	3.35	96	3.28	126	3.07	156	3.96	186	3.11		
7	2.76	37	2.91	67	3.45	97	3.01	127	3.77	157	2.84	187	3.51		
8	3.15	38	3.15	68	3.00	98	3.07	128	2.64	158	2.35	188	3.46		
9	3.27	39	3.15	69	2.83	99	3.02	129	3.15	159	2.85	189	3.31		
10	2.87	40	3.36	70	3.04	100	2.95	130	2.76	160	2.34	190	3.48		
11	3.06	41	3.53	71	2.85	101	3.30	131	3.26	161	2.45	191	3.46		
12	2.36	42	3.29	72	3.10	102	2.95	132	3.07	162	2.47	192	3.76		
13	2.91	43	3.07	73	3.42	103	2.20	133	3.17	163	3.49	193	3.36		
14	3.15	44	2.85	74	2.65	104	3.15	134	2.94	164	2.94	194	3.10		
15	3.14	45	3.11	75	3.26	105	2.66	135	3.23	165	3.31	195	3.29		
16	2.60	46	3.44	76	3.10	106	3.33	136	3.46	166	3.54	196	2.83		
17	3.30	47	3.16	77	2.95	107	3.56	137	2.95	167	2.54	197	2.34		
18	2.97	48	2.68	78	2.76	108	3.15	138	2.79	168	2.63	198	2.28		
19	2.83	49	2.95	79	3.13	109	3.24	139	2.75	169	2.93	199	2.94		
20	2.70	50	2.97	80	2.94	110	3.00	140	2.24	170	3.39	200	3.50		
21	2.95	51	3.17	81	3.42	111	2.70	141	3.68	171	3.00	201	3.00		
22	3.35	52	3.48	82	3.30	112	2.94	142	2.72	172	2.93	202	3.20		
23	3.26	53	3.56	83	2.95	113	2.85	143	3.35	173	3.01	203	3.17		
24	3.51	54	3.34	84	3.38	114	2.99	144	2.85	174	1.58	204	2.85		
25	3.16	55	3.58	85	3.30	115	3.00	145	3.33	175	3.07	205	2.67		
26	3.21	56	3.05	86	3.09	116	3.06	146	2.78	176	2.57	206	3.44		
27	2.65	57	2.97	87	3.45	117	3.04	147	3.23	177	2.52	207	3.10		
28	3.06	58	2.95	88	3.53	118	3.15	148	3.42	178	2.16	208	3.52		
29	3.15	59	3.33	89	2.97	119	3.35	149	3.47	179	2.63	209	3.05		
30	3.13	60	3.37	90	3.32	120	2.50	150	3.31	180	2.69				

Appendix 2b: Kerf Width (mm) of Swage-Set Saw 2

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	3.11	31	3.18	61	3.29	91	2.99	121	3.41	151	2.78	181	3.40		
2	3.42	32	3.23	62	3.40	92	3.40	122	3.46	152	3.09	182	3.17		
3	3.03	33	3.02	63	3.33	93	3.23	123	3.25	153	2.47	183	3.25		
4	3.35	34	1.98	64	3.26	94	2.79	124	3.18	154	1.63	184	3.20		
5	3.17	35	3.26	65	3.16	95	2.82	125	3.07	155	1.99	185	3.49		
6	3.23	36	3.25	66	3.24	96	2.94	126	3.09	156	3.08	186	3.17		
7	3.20	37	3.16	67	3.31	97	2.65	127	3.12	157	1.72	187	3.11		
8	3.22	38	3.31	68	3.23	98	2.95	128	3.06	158	1.60	188	3.13		
9	2.83	39	3.31	69	3.37	99	2.65	129	3.24	159	1.43	189	2.97		
10	3.18	40	3.26	70	3.29	100	2.99	130	3.23	160	1.69	190	3.02		
11	3.18	41	3.10	71	2.50	101	2.80	131	3.18	161	1.67	191	3.09		
12	3.26	42	3.06	72	3.05	102	2.90	132	3.23	162	2.73	192	3.09		
13	3.67	43	3.00	73	3.23	103	2.31	133	3.07	163	1.61	193	3.18		
14	3.20	44	3.10	74	3.32	104	3.02	134	3.23	164	3.23	194	3.15		
15	3.50	45	3.00	75	3.32	105	2.83	135	3.05	165	3.16	195	3.36		
16	3.08	46	2.96	76	3.11	106	3.02	136	2.86	166	3.22	196	3.03		
17	3.27	47	2.57	77	3.06	107	3.03	137	3.06	167	3.31	197	3.06		
18	3.34	48	1.70	78	3.09	108	3.26	138	2.94	168	3.22	198	2.98		
19	3.22	49	3.22	79	3.03	109	3.08	139	3.23	169	3.35	199	3.07		
20	2.92	50	3.25	80	3.26	110	3.15	140	3.27	170	2.83	200	2.96		
21	3.11	51	3.15	81	3.26	111	3.23	141	2.96	171	3.08	201	3.29		
22	3.10	52	2.95	82	3.15	112	3.18	142	3.21	172	3.11	202	3.01		
23	3.10	53	2.98	83	1.82	113	3.25	143	3.07	173	3.14	203	3.35		
24	2.84	54	3.01	84	1.85	114	3.20	144	3.32	174	3.10	204	3.01		
25	3.03	55	3.49	85	1.79	115	3.35	145	3.32	175	2.57	205	3.10		
26	3.16	56	2.78	86	2.73	116	3.18	146	3.22	176	3.01	206	3.06		
27	3.21	57	3.08	87	3.16	117	3.50	147	3.15	177	3.11	207	3.20		
28	3.10	58	2.92	88	3.11	118	3.34	148	3.26	178	3.35	208	3.10		
29	3.16	59	3.13	89	3.34	119	3.39	149	3.30	179	3.21	209	3.20		
30	3.03	60	3.10	90	3.33	120	3.35	150	3.19	180	3.33				

Appendix 2c: Kerf Width(mm) of Swage-Set Saw 3

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	3.85	31	2.26	61	3.47	91	3.33	121	2.80	151	3.58	181	3.20
2	3.59	32	3.24	62	3.40	92	2.91	122	2.54	152	3.41	182	3.51
3	3.12	33	3.68	63	3.88	93	3.31	123	2.24	153	3.54	183	3.15
4	3.15	34	3.91	64	3.45	94	2.91	124	2.53	154	4.04	184	3.35
5	3.39	35	3.71	65	3.60	95	3.13	125	2.90	155	3.80	185	3.36
6	3.48	36	3.51	66	4.07	96	3.00	126	2.13	156	3.78	186	3.73
7	3.29	37	3.68	67	3.88	97	3.56	127	3.13	157	3.78	187	3.71
8	2.69	38	3.22	68	3.31	98	3.15	128	3.41	158	3.90	188	3.56
9	3.42	39	3.57	69	3.22	99	2.27	129	3.38	159	3.85	189	2.38
10	3.32	40	3.68	70	3.06	100	3.61	130	3.40	160	3.88	190	3.44
11	3.11	41	3.69	71	3.46	101	3.02	131	3.58	161	3.94	191	3.56
12	3.67	42	3.63	72	3.19	102	2.60	132	3.70	162	3.37	192	3.52
13	2.26	43	3.79	73	3.41	103	1.61	133	3.71	163	3.57	193	3.35
14	2.87	44	3.45	74	3.27	104	3.30	134	3.55	164	3.47	194	3.52
15	2.80	45	2.44	75	3.58	105	3.42	135	3.49	165	3.77	195	3.44
16	3.91	46	3.49	76	3.40	106	3.95	136	2.61	166	3.35	196	2.97
17	3.16	47	2.84	77	3.29	107	3.70	137	3.82	167	3.17	197	2.98
18	3.02	48	3.09	78	3.33	108	3.78	138	3.78	168	3.64	198	2.79
19	2.65	49	3.31	79	3.49	109	3.49	139	3.40	169	3.20	199	3.74
20	2.87	50	2.27	80	4.03	110	3.40	140	3.51	170	3.50	200	3.64
21	2.90	51	2.94	81	3.37	111	3.51	141	3.30	171	3.77	201	2.90
22	3.01	52	2.95	82	3.77	112	3.53	142	3.88	172	3.92	202	3.41
23	3.09	53	2.47	83	3.33	113	3.50	143	3.86	173	3.57	203	3.65
24	3.13	54	1.95	84	3.56	114	3.51	144	3.01	174	3.69	204	3.01
25	2.94	55	2.58	85	3.35	115	2.80	145	3.85	175	3.06	205	3.80
26	3.58	56	2.95	86	3.05	116	3.69	146	3.59	176	3.29	206	2.98
27	3.79	57	2.86	87	3.19	117	3.46	147	3.48	177	3.23	207	3.14
28	3.64	58	3.12	88	3.17	118	3.80	148	3.15	178	2.76	208	3.76
29	3.72	59	2.58	89	3.27	119	3.82	149	3.08	179	3.05	209	3.52
30	3.70	60	2.16	90	3.89	120	3.71	150	3.15	180	3.27		

Appendix 2d: Kerf Width(mm) of Swage-Set Saw 4

Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)	Tooth No	Saw Kerf (mm)
1	2.79	31	2.51	61	2.49	91	3.03	121	2.61	151	2.66	181	3.04
2	2.44	32	2.99	62	2.62	92	2.83	122	2.41	152	2.61	182	3.15
3	2.54	33	3.47	63	2.84	93	2.44	123	2.77	153	2.65	183	2.57
4	2.46	34	2.87	64	2.81	94	3.32	124	2.93	154	2.75	184	2.58
5	3.01	35	2.56	65	3.21	95	2.89	125	1.98	155	2.88	185	2.88
6	2.45	36	2.83	66	2.64	96	1.84	126	3.02	156	2.19	186	2.52
7	2.64	37	2.97	67	2.86	97	2.29	127	3.36	157	2.50	187	2.96
8	3.05	38	3.60	68	1.73	98	2.69	128	2.81	158	2.52	188	2.57
9	2.60	39	3.18	69	2.73	99	2.66	129	2.94	159	2.22	189	2.70
10	2.95	40	3.56	70	2.41	100	2.18	130	1.55	160	2.18	190	2.32
11	3.05	41	3.81	71	2.68	101	2.48	131	2.61	161	2.96	191	2.65
12	3.02	42	3.92	72	3.19	102	2.90	132	3.62	162	2.85	192	2.99
13	2.50	43	3.19	73	2.94	103	2.59	133	2.57	163	2.68	193	3.13
14	3.06	44	3.00	74	3.10	104	2.73	134	1.78	164	2.67	194	3.07
15	3.47	45	3.16	75	3.06	105	2.86	135	2.90	165	3.30	195	3.40
16	2.96	46	3.14	76	2.47	106	2.67	136	3.77	166	2.86	196	2.70
17	2.87	47	3.17	77	3.15	107	3.05	137	2.34	167	3.11	197	2.81
18	3.06	48	2.81	78	3.38	108	2.74	138	3.00	168	2.57	198	2.71
19	2.94	49	3.16	79	2.37	109	2.22	139	2.52	169	3.19	199	2.69
20	2.26	50	2.80	80	2.42	110	2.91	140	2.44	170	2.86	200	2.77
21	3.03	51	2.66	81	2.73	111	3.00	141	2.48	171	2.88	201	2.40
22	2.25	52	2.94	82	3.12	112	2.63	142	3.22	172	2.70	202	2.43
23	2.68	53	2.63	83	2.69	113	2.72	143	3.01	173	2.55	203	2.73
24	2.79	54	2.66	84	3.17	114	2.57	144	3.47	174	2.70	204	2.10
25	3.06	55	2.52	85	2.30	115	2.37	145	3.19	175	2.66	205	2.96
26	2.64	56	3.26	86	2.20	116	2.78	146	2.31	176	2.58	206	2.90
27	2.73	57	2.48	87	2.29	117	2.49	147	2.84	177	2.48	207	2.71
28	2.01	58	2.75	88	2.97	118	2.53	148	2.76	178	2.49	208	2.56
29	2.67	59	2.64	89	2.75	119	2.63	149	2.63	179	2.87	209	1.56
30	2.64	60	2.50	90	3.21	120	2.47	150	2.88	180	3.01		

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Appendix 3: Thickness of Sawn Boards for Stellite-Tipped Saw

Saw No.	1		2		3		4	
Board No.	Thickness (mm)	SD	Thickness (mm)	SD	Thickness (mm)	SD	Thickness (mm)	SD
1	41.84	1.0139	39.14	0.6832	42.24	0.8422	42.73	0.5310
2	42.03	1.3590	38.64	1.6761	43.06	0.8272	41.68	0.7710
3	41.97	1.2873	38.38	1.7870	41.88	2.1939	40.38	1.9296
4	44.13	0.6667	38.58	1.2138	44.12	2.5255	41.87	0.6648
5	42.40	1.6094	38.68	1.8807	43.31	0.9310	41.83	0.6477
6	43.64	0.9072	39.44	1.5884	43.10	0.8595	42.75	1.0630
7	42.84	1.7743	38.64	1.6761	43.37	1.1444	41.97	1.2873
8	41.77	1.4584	38.37	1.7319	43.08	1.0165	42.01	1.5000
9	42.75	0.9385	39.34	0.7440	43.27	1.1206	42.03	1.3590
10	42.42	0.9197	38.58	1.2138	43.06	0.8272	48.08	1.0165

Legend : SD=Standard deviation

Appendix 4: Thickness of Sawn Boards for Swage-Set Saw

Saw No.	1		2		3		4	
Board No.	Thickness (mm)	SD	Thickness (mm)	SD	Thickness (mm)	SD	Thickness (mm)	SD
1	42.91	0.9072	42.84	1.7743	41.51	0.8975	42.33	0.3899
2	42.54	0.8842	42.34	0.3628	41.38	1.7413	42.21	1.3010
3	43.08	1.0165	41.88	0.8205	42.78	0.6006	42.09	0.3248
4	42.73	0.8273	43.20	0.6955	42.42	0.9197	42.57	0.6419
5	43.31	0.6896	43.40	1.1747	41.06	0.7266	42.09	0.6107
6	42.95	0.6285	42.55	0.7483	42.01	1.3460	42.41	0.6188
7	42.97	1.1088	42.27	1.1206	42.34	0.8437	42.22	1.0895
8	42.24	0.8422	42.25	1.1225	42.46	0.9093	42.20	1.4967
9	42.71	0.9100	42.06	1.1653	42.05	1.1979	42.20	0.7840
10	42.31	1.3315	42.00	0.9028	42.01	1.5000	42.07	0.9032

egend : SD=Standard deviation

Appendix 5a : Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K1

Tooth No	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No.	Out	In
1	1 25	1.30	43	1.50	1.00	85	1.25	1.25	127	1.25	1.05	169	1.30	1.20
2	1 20	1 45	44	1.45	1 00	86	1.10	1.25	128	1.20	1.20	170	1.20	1.20
3	1-30	1 35	45	1.30	1.05	87	1.20	1.30	129	1.25	1.10	171	1.30	1.25
4	1 35	1 25	46	1.30	1.15	88	1.15	1.25	130	1.40	1.10	172	1.25	1.15
5	1 35	1.25	47	1.15	1.05	89	1.20	1.25	131	1.30	1.20	173	1.20	1.15
6	1 10	1 25	48	1.05	1.15	90	1.05	1.20	132	1.25	1.15	174	1.25	1.10
7	1 25	1.25	49	1.10	1.10	91	1.15	1.25	133	1.35	1.15	175	1 30	1.15
8	1 20	1.20	50	1.05	1 15	92	1.25	1.15	134	1 30	1.15	176	1.35	1.20
9	1 30	1.20	51	1.05	1.10	93	1.30	1.15	135	1 20	1.20	177	1.30	1.20
10	1 15	1.35	52	1.15	1.00	94	1.30	1.10	136	1.30	1.15	178	1.35	1.20
11	1 25	1.15	53	1.20	1.15	95	1.20	1.15	137	1.20	1.20	179	1.40	1.15
12	1 15	1.20	54	1.25	1 10	96	1.20	1.00	138	1.30	1.20	180	1.25	1.20
13	1 30	1 25	55	1.25	1.15	97	1.20	1.05	139	1.30	1.15	181	1.15	1.10
14	1 20	1.20	56	1.25	1.15	98	1.25	1.10	140	1.25	1.20	182	1.20	1.40
15	1 30	1.20	57	1 25	1.10	99	1.20	1.20	141	1.20	1.15	183	1.25	1.15
16	1 40	1 15	58	1 25	1 15	100	1.20	1.15	142	1 25	1 20	184	1 25	1.15
17	1 15	1 20	59	1 25	1 15	101	1 35	1 10	143	1 25	1.25	185	1 10	1 25
18	1 35	1 30	60	1 20	1 10	102	1.20	1.10	144	1 15	1.25	186	1 10	1 15
19	1 35	1 15	61	1 30	1 15	103	1.25	1 20	145	1 20	1.15	187	1 30	1.20
20	1 35	1 15	62	1 40	1.05	104	1.35	1 10	146	1 20	1 20	188	1 25	1.00
21	1 35	1.20	63	1 35	1 20	105	1.25	1 10	147	1 20	1 15	189	1 40	1.10
22	1 40	1 10	64	1 40	1 20	106	1.30	1 15	148	1 25	1 20	190	1 30	1.10
23	1 40	1 10	65	1.45	1.15	107	1.30	1 20	149	1 30	1.20	191	1.35	0.95
24	1 30	1 20	66	1.30	1 00	108	1.30	1 15	150	1 30	1 20	192	1 10	1.20
25	1.35	1.10	67	1.25	1 05	109	1 35	1 20	151	1 30	1.15	193	1 50	1.15
26	1 30	1 05	68	1 15	1 05	110	1.25	1 15	152	1.30	1.15	194	1 35	1.15
27	1 30	1.15	69	1.25	1.10	111	1.25	1 05	153	1 20	1.15	195	1 25	1.10
28	1 40	1.10	70	1 25	0.95	112	1.30	1 20	154	1.30	1.20	196	1 20	1.15
29	1 35	1 20	71	1.20	1.05	113	1.25	1 20	155	1 25	1.20	197	1 05	1.25
30	1 35	1.10	72	1.35	1 10	114	1.35	1.15	156	1.20	1.20	198	1 20	1.20
31	1 40	1.10	73	1.30	1 10	115	1.40	1.15	157	1 25	1.20	199	1.15	1.15
32	1 30	1 10	74	1.35	1.00	116	1.25	1.10	158	1.20	1.20	200	1.20	1.25
33	1.30	1.10	75	1.30	1.10	117	1.30	1.15	159	1.20	1.20	201	1 15	1.15
34	1 20	1.20	76	1.35	1.05	118	1.20	1.15	160	1 15	1.15	202	1.20	1.15
35	1 20	1.25	77	1.30	1 10	119	1.20	1.15	161	1.20	1.20	203	1.20	1.10
36	1 25	1.15	78	1.30	1.10	120	1.20	1.10	162	1.20	1.20	204	1.25	1.10
37	1.20	1.20	79	1.30	1.20	121	1.20	1.20	163	1.30	1.20	205	1.30	1.15
38	1 40	1.10	80	1.35	1.40	122	1.10	1.15	164	1.40	1.15	206	1.50	1.15
39	1 35	1.10	81	1.40	1.30	123	1.15	1.25	165	1.35	1.20	207	1 45	1.10
40	1.40	1.20	82	1.40	1.30	124	1.20	1.20	166	1.30	1.20	208	1 25	1.35
41	1.25	1.15	83	1.30	1.15	125	1.30	1.25	167	1 30	1.15	209	1 20	1.25
42	1.20	1.15	84	1.25	1.05	126	1.40	1.00	168	1 25	1.15			

Appendix 5b: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K2

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	1.45	0.85	43	1.40	1.00	85	1.35	1.20	127	1.25	1.10	169	1.20	1.15
2	1.15	1.15	44	1.40	1.05	86	1.30	1.15	128	1.30	1.05	170	1.20	1.10
3	1.25	1.05	45	1.35	1.00	87	1.25	1.20	129	1.30	1.00	171	1.20	1.15
4	1.15	1.00	46	1.30	1.05	88	1.25	1.20	130	1.40	1.15	172	1.25	1.20
5	1.20	1.05	47	1.25	1.10	89	1.35	1.10	131	1.25	1.00	173	1.25	1.20
6	1.35	1.00	48	1.25	1.15	90	1.30	1.15	132	1.20	1.05	174	1.15	1.15
7	1.25	1.10	49	1.30	1.05	91	1.25	1.25	133	1.15	1.10	175	1.15	1.25
8	1.25	1.05	50	1.25	1.15	92	1.35	1.20	134	1.35	1.10	176	1.15	1.10
9	1.15	1.10	51	1.30	1.00	93	1.30	1.20	135	1.15	1.05	177	1.25	1.15
10	1.30	1.20	52	1.25	1.05	94	1.30	1.15	136	1.20	1.00	178	1.25	1.15
11	1.40	1.00	53	1.30	1.05	95	1.20	1.20	137	1.15	1.10	179	1.20	1.15
12	1.35	1.15	54	1.25	1.05	96	1.35	1.05	138	1.35	1.05	180	1.35	0.80
13	1.30	1.20	55	1.25	1.05	97	1.35	1.10	139	1.35	1.05	181	1.55	0.90
14	1.30	1.15	56	1.20	1.10	98	1.35	1.15	140	1.30	1.10	182	1.40	1.25
15	1.20	1.20	57	1.30	1.05	99	1.30	1.10	141	1.40	1.10	183	1.25	1.20
16	1.20	1.20	58	1.30	1.10	100	1.30	1.10	142	1.40	1.05	184	1.20	1.20
17	1.20	1.10	59	1.20	1.15	101	1.40	1.10	143	1.30	1.10	185	1.20	1.15
18	1.25	1.10	60	1.35	1.10	102	1.20	1.20	144	1.45	1.10	186	1.25	1.15
19	1.10	1.25	61	1.35	1.10	103	1.30	1.10	145	1.35	1.10	187	1.30	1.10
20	1.25	1.10	62	1.30	1.15	104	1.25	1.10	146	1.30	1.05	188	1.25	1.15
21	1.25	1.10	63	1.30	1.15	105	1.30	1.15	147	1.30	1.15	189	1.25	1.10
22	1.25	1.05	64	1.35	1.10	106	1.35	1.05	148	1.40	1.20	190	1.20	1.05
23	1.40	1.10	65	1.25	1.10	107	1.35	1.10	149	1.35	1.15	191	1.05	1.05
24	1.30	0.95	66	1.35	1.10	108	1.40	1.10	150	1.35	1.05	1192	1.30	1.05
25	1.30	1.00	67	1.30	1.10	109	1.50	1.10	151	1.25	1.10	193	1.30	1.15
26	1.25	1.05	68	1.25	1.15	110	1.35	1.05	152	1.25	1.00	194	1.20	1.20
27	1.30	1.15	69	1.25	1.15	111	1.45	1.10	153	1.30	1.00	195	1.25	1.10
28	1.25	1.20	70	1.20	1.15	112	1.30	1.00	154	1.25	0.95	196	1.25	1.10
29	1.35	1.10	71	1.20	1.15	113	1.40	1.10	155	1.25	1.05	197	1.35	1.10
30	1.30	1.05	72	1.20	1.20	114	1.30	1.10	156	1.25	1.10	198	1.30	1.15
31	1.25	1.25	73	1.10	1.20	115	1.35	1.10	157	1.30	1.50	199	1.30	1.10
32	1.20	1.10	74	1.15	1.20	116	1.25	1.05	158	1.30	0.95	200	1.30	1.10
33	1.35	1.15	75	1.30	1.15	117	1.25	1.10	159	1.30	1.00	201	1.20	1.00
34	1.30	1.20	76	1.25	1.20	118	1.30	1.00	160	1.35	1.10	202	1.35	1.05
35	1.25	1.20	77	1.35	1.15	119	1.35	1.10	161	1.30	1.10	203	1.35	1.10
36	1.30	1.20	78	1.30	1.10	120	1.35	1.10	162	1.30	1.10	204	1.35	1.20
37	1.40	1.20	79	1.25	1.10	121	1.30	1.15	163	1.25	1.20	205	1.20	1.15
38	1.20	1.20	80	1.25	1.10	122	1.45	1.10	164	1.25	1.40	206	1.25	1.15
39	1.20	1.20	81	1.25	1.05	123	1.30	1.15	165	1.35	1.25	207	1.30	1.15
40	1.20	1.25	82	1.25	1.20	124	1.20	1.15	166	1.40	1.25	208	1.35	1.10
41	1.20	1.10	83	1.25	1.20	125	1.35	1.10	167	1.35	1.15	209	1.15	1.20
42	1.20	1.10	84	1.25	1.15	126	1.40	1.10	168	1.35	1.05			

ndix 5c: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K3

h o.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	1.45	1.00	43	1.25	1.00	85	1.15	1 05	127	1.20	0 90	169	1.20	1.10
2	1.20	1.05	44	1.30	1.05	86	1.25	1 20	128	1 30	0.90	170	1 15	1.15
3	1.25	0.90	45	1.35	1.00	87	1.35	1 10	129	1 25	1.05	171	1 15	1.20
4	1.30	0.85	46	1.35	1.05	88	1 30	1.05	130	1 25	0.95	172	1.10	1.20
5	1.20	0.95	47	1.30	1.15	89	1.30	1.10	131	1.20	1.05	173	1.10	1.15
6	1.25	1.00	48	1.30	1.10	90	1.25	1.10	132	1.20	1.00	174	1.20	1.10
7	1.35	1.00	49	1.20	1.10	91	1.30	1 10	133	1.10	0.95	175	1 30	1.15
8	1.20	1.00	50	1.35	1.10	92	1.20	1 15	134	1.15	0.90	176	1.35	1.03
9	1.10	1.10	51	1.35	0.95	93	1.35	1.10	135	1 15	0.90	177	1 20	1.00
0	1 35	1.05	52	1.30	0.95	94	1.25	1 20	136	1 15	0.95	178	1 40	0.80
1	1 30	0 95	53	1.35	1.00	95	1.25	1 00	137	1 20	0.95	179	1 35	0.90
2	1.45	1 10	54	1.30	1.00	96	1 10	1 05	138	1 20	0 95	180	1 35	0.80
3	1.35	1.05	55	1.30	1.00	97	1.20	1 05	139	1.20	0.95	181	1 30	0.90
4	1 35	1.05	56	1.15	1.10	98	1.30	1.00	140	1.20	0.95	182	1.20	1.20
5	1 30	1 10	57	1.30	1.00	99	1.30	1 05	141	1.20	0.95	183	1.25	1.20
6	1.25	1.10	58	1.30	1.10	100	1 25	1 05	142	1 25	1.00	184	1.25	1.10
7	1 25	1.05	59	1.35	1.10	101	1.30	1 10	143	1 10	1 10	185	1 25	1.20
8	1.30	1 10	60	1.30	1.10	102	1.30	1 05	144	1.20	0 95	186	1 20	1.10
9	1 10	1 25	61	1.35	1.10	103	1.20	1 00	145	1 15	0 95	187	1 15	1.00
0	1 15	1.05	62	1.30	1.10	104	1 15	1 10	146	1 15	1 10	188	1 45	0.85
1	1 20	1.10	63	1.35	1.10	105	1.20	1 05	147	1 20	1.05	189	1 40	1.00
2	1 30	1.00	64	1.35	1.10	106	1.25	1 05	148	1 20	1.05	190	1 55	1.05
3	1 25	1.10	65	1.25	1.10	107	1 20	1 10	149	1 30	0.95	191	1 30	1.05
4	1 35	0.95	66	1.30	1.15	108	0.90	1 10	150	1 15	1 00	192	1 30	1.15
5	1 20	1.00	67	1.30	1.10	109	1.20	1 00	151	1 35	0.95	193	1 00	1.15
6	1.15	1 05	68	1 35	1 10	110	1 15	1 05	152	1 30	1 00	194	1 05	1 10
7	1 20	1.15	69	1.35	1.10	111	1 20	1 05	153	1 30	0.90	195	1 10	1.10
8	1 30	1 15	70	1.25	1.15	112	1 25	1 05	154	1 15	1 00	196	1 15	1.15
9	1.15	1.00	71	1.25	1.20	113	1 20	1 05	155	1 15	1 00	197	1 00	1.15
0	1 25	1.05	72	1.25	1.20	114	1 25	1 05	156	1 10	1 05	198	1 10	1.00
1	1 20	1 20	73	1.25	1.15	115	1.20	1 00	157	1 05	1.05	199	1 25	1.10
2	1 25	1.05	74	1.20	1.15	116	1.20	1 10	158	1 30	1.05	200	1 10	1.00
3	1 30	1.00	75	1.25	1.15	117	1.20	1 10	159	1 20	1.00	201	1.20	0.85
4	1.40	0.90	76	1.20	1.15	118	1.15	1 10	160	1 15	1.00	202	1.25	0.95
5	1.25	1.00	77	1.25	1.15	119	1.15	1 10	161	1.20	0.95	203	1.20	0.90
6	1.35	0.95	78	1.30	1.10	120	1.10	1 10	162	1 25	1 05	204	1 25	0.90
7	1.20	1.10	79	1.35	1.10	121	1.00	1 05	163	1 10	1.20	205	1 25	0.95
8	1 25	1.05	80	1.25	1.10	122	1.20	1 10	164	1 20	1.20	206	1.15	1.00
9	1 20	1.05	81	1.25	1.20	123	1.10	1 10	165	1 20	1 15	207	1.15	0.90
0	1.30	1.10	82	1.30	1.20	124	1.15	1 15	166	1 20	1.00	208	1 30	1 05
1	1.20	1.05	83	1.25	1.10	125	1.15	1 05	167	1 25	1 05	209	1 20	1 10
2	1.20	1.10	84	1.30	1.25	126	1 05	1 05	168	1 20	1.20			

ppendix 5d: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K4

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	1.20	1.05	43	1.25	1 00	85	1.10	1 10	127	1.15	0 95	169	1 15	1 05
2	1.00	1.15	44	1.35	0 00	86	1 15	1 00	128	1.25	0 95	170	1 10	1.05
3	1.10	0.95	45	1.35	0 90	87	1.05	1 15	129	1.25	0.95	171	1 20	1 10
4	1.15	1.00	46	1.20	0.95	88	1.20	0 00	130	1.25	1.00	172	1 10	1 10
5	1.05	1.00	47	1.20	1.10	89	1.15	0.00	131	1.20	1.00	173	1 25	1 10
6	1.15	1.00	48	1.15	1 05	90	1.15	0.05	132	1.15	1.00	174	1 30	1 00
7	1.30	0.95	49	1.20	0.05	91	1.15	0.05	133	1.10	0.95	175	1 10	1 05
8	1.20	1.05	50	1.25	0.05	92	1.20	0.05	134	1.15	0.95	176	1 10	1.00
9	1.05	1.00	51	1.25	0.95	93	1.15	0.05	135	1.15	0.90	177	1 10	1 05
10	1.20	0.95	52	1.20	0 90	94	1.20	0.00	136	1.15	0.90	178	1 05	1.05
11	1.20	0.95	53	1.25	0.95	95	1.15	0.15	137	1.15	0.90	179	1 20	0 95
12	1.35	1.00	54	1.30	0.95	96	1.15	0.95	138	1.25	1.00	180	1 20	0 85
13	1.30	1.00	55	1.30	0.90	97	1.25	1.00	139	1.10	0.90	181	1 20	1 00
14	1.25	1.00	56	1.25	1.00	98	1.30	0.05	140	1.15	0.90	182	1 20	0 15
15	1.20	1.05	57	1.20	0.95	99	1.20	1.00	141	1.15	0.95	183	1 20	0 10
16	1.20	1.05	58	1.25	1.00	100	1.25	0.95	142	1.15	0.95	184	1 25	0 10
17	1.15	1.05	59	1 20	1.05	101	1.25	1.00	143	1.10	1.05	185	1 15	0.00
18	1.20	1.00	60	1 25	1.00	102	1.10	1.05	144	1.25	0.85	186	1 10	0 10
19	1.15	1.15	61	1.25	1.00	103	1.20	1.00	145	0.95	1.00	187	1 15	0 00
20	1.20	1.00	62	1.30	1.05	104	1.20	0.95	146	1.20	0.90	188	1 35	0 95
21	1.10	1.05	63	1 25	1 00	105	1.25	1.00	147	1.15	1.00	189	1 40	0 85
22	1.20	0.95	64	1.25	1.05	106	1.25	1.00	148	1.15	1 05	190	1 30	0 90
23	1.20	1.00	65	1 25	1 05	107	1.15	1.00	149	1.20	1 05	191	1 20	0 95
24	1.20	0.90	66	1 20	1 00	108	1 30	1 00	150	1.25	0.90	192	1 20	1 00
25	1.15	0.90	67	1 30	1 00	109	1.25	1.00	151	1 40	0 95	193	1 15	1 10
26	1.20	1.00	68	1 35	1.05	110	1 30	0.95	152	1.35	0 85	194	1 25	0 95
27	1.20	1.05	69	1 30	1 00	111	1.25	1 00	153	1 00	0.95	195	1 20	1.00
28	1 20	1.00	70	1 20	1 10	112	1.25	0 95	154	1.10	0 95	196	1 15	0 05
29	1.15	1.00	71	1.25	1 10	113	1.25	0.00	155	1.25	1 00	197	1 00	0 05
30	1.20	0 95	72	1 20	1 10	114	1 15	0 95	156	1.20	0.95	198	1 00	1 00
31	1.10	1.10	73	1 20	0 05	115	1.10	1 00	157	1.20	0 90	199	1 15	0 60
32	1.15	1.00	74	1 15	0 10	116	1.10	1.00	158	1.15	1 00	200	1 15	1 00
33	1.25	0.85	75	1 15	0.10	117	1.25	0.05	159	1.15	1.00	201	1 20	0 90
34	1.30	0.85	76	1.20	0 10	118	1.10	1.00	160	1.25	0.95	202	1 35	0 85
35	1.15	1.05	77	1 15	0 05	119	1.10	1.00	161	1.15	1.00	203	1 00	1 00
36	1.30	0.90	78	1.20	0 05	120	1.05	0.95	162	1.15	0 95	204	1 15	1 00
37	1.15	1.05	79	1 10	0 00	121	1.15	1.00	163	1.10	1 10	205	1 20	0 95
38	1.10	0 95	80	1.15	0.00	122	1.90	0.95	164	1.10	1 25	206	1 15	1 05
39	1.05	0.95	81	1.15	0.05	123	1.10	1.00	165	0.95	1.15	207	1 15	1 10
40	1.20	1.05	82	1.15	0.15	124	1.10	0.05	166	1.00	1.10	208	1.25	1 10
41	1.15	1.00	83	1 05	0 10	125	1.10	1 00	167	1.20	1 00	209	1 10	1 00
42	1 10	1.05	84	1 15	0 05	126	1.10	1.00	168	1.25	0 90			

Appendix 5e: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K5

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0 75	0 80	43	0 70	0 80	85	0 50	0 65	127	0 65	0 70	169	0.70	0.75
2	0 85	0 60	44	0 65	0 80	86	0 75	0 85	128	0 55	0 80	170	0 65	0 80
3	0.70	0.65	45	0 65	0.75	87	0.90	0 80	129	0 70	0.95	171	0.65	0.65
4	0.70	0.80	46	0.70	0.65	88	0.65	0 80	130	0 60	0.80	172	0.50	0.95
5	0 85	0.60	47	0 85	0.70	89	0.75	0.80	131	0.60	0.70	173	0.45	0.50
6	0.85	0.70	48	0 75	0.70	90	0.75	0 75	132	0.65	0.60	174	0.70	0 85
7	0.80	0.75	49	0.75	0.75	91	0.80	0.75	133	0.65	0 70	175	0.65	0.65
8	0.70	0.85	50	0.80	0.70	92	0.80	0 80	134	0.65	0.65	176	0.70	0 75
9	0.65	0 75	51	0 65	0 75	93	0 85	0.80	135	0.60	0.70	177	0.75	0.50
10	0 65	0.80	52	0 65	0.75	94	0.75	0.75	136	0.65	0.90	178	0.80	0.70
11	0.60	0 75	53	0 70	0.75	95	0.90	0.85	137	0.75	0.75	179	0.75	0.85
12	0.75	0.85	54	0 70	0.90	96	0 65	0 85	138	0.45	0.75	180	5.00	0.75
13	0 70	0 80	55	0 65	0 85	97	0.65	0 10	139	0.70	0.75	181	0.70	0.75
14	0 75	0.75	56	0 80	0 80	98	0 65	0 75	140	0.65	0.85	182	0.85	0 75
15	0 70	0.70	57	0 75	0.65	99	0.65	0.80	141	0.50	0.55	183	0.85	0.75
16	0.70	0.75	58	0 80	0.70	100	0 65	0 75	142	0.55	1.00	184	0.70	0.70
17	0.70	0.75	59	0.80	0 75	101	0 65	0 70	143	0.40	0.30	185	0 65	0.65
18	0 75	0 60	60	0 75	0.70	102	0 70	0 70	144	0.00	0.60	186	0.70	0.30
19	0 80	0.65	61	0 80	0 85	103	0 70	0 65	145	0.60	0.60	187	0.65	0.65
20	0 65	0 65	62	0 80	0 85	104	0 65	0 80	146	0.65	0.15	188	0.70	0 70
21	0 75	0 60	63	0 80	0 85	105	0 80	0 10	147	0 65	0.55	189	0.55	0 70
22	0 65	0.70	64	0 70	0 75	106	0 55	0 70	148	0 15	0.80	190	0.70	0 75
23	0 75	0 65	65	0 70	0 75	107	0 10	0 60	149	0 60	0 30	191	0 65	0 55
24	0 55	0 80	66	0 80	0 85	108	0 35	0 60	150	0 40	1 10	192	0 60	0 75
25	0 65	0 60	67	0 75	0 80	109	1 00	0 85	151	0 75	0 60	193	0 90	0 65
26	0.70	0 65	68	0.80	0 75	110	0 85	0 80	152	0.55	0 60	194	0 60	0 70
27	0 75	0 75	69	0 70	0 80	111	0 75	0 60	153	0 70	0 65	195	0 70	0 75
28	0 60	0 85	70	0 75	0 85	112	0 80	0 70	154	0 65	0 75	196	0 65	0 00
29	0 60	0 80	71	0 75	0 80	113	0 80	0 55	155	0 60	0 70	197	0 60	0 00
30	0 65	0 75	72	0 75	0 30	114	0 80	0 50	156	0 65	0 70	198	1 05	0 60
31	0 80	0 70	73	1 05	0 60	115	0 80	0 60	157	0 70	0 65	199	0 60	0 55
32	0 60	0 75	74	1 00	0 75	116	0 85	0 60	158	0 70	0 75	200	0 55	0 00
33	0 60	0 70	75	0 90	0 65	117	0 85	0 70	159	0 70	0 80	201	0 35	0 70
34	0 55	0 55	76	1 00	0 75	118	0 85	0 80	160	0 60	0 75	202	0 00	0 65
35	0 65	0 40	77	0 90	0 60	119	0 75	1 00	161	0 70	0 70	203	0 30	0 80
36	0 60	0 30	78	0 80	0 70	120	0 60	0 80	162	0 80	0 75	204	0 70	0 60
37	0 75	0 50	79	0 80	0 60	121	0 50	0 75	163	0 75	0 90	205	0 55	0 65
38	0 45	0 00	80	0 75	0 65	122	0 60	0 55	164	0 70	0 75	206	0 70	0 70
39	0 90	0 30	81	0 70	0 75	123	0 70	0 60	165	0 75	0 80	207	0 60	0 85
40	0 85	0 40	82	0 80	0 80	124	0 70	0 55	166	0 65	0 75	208	1 00	0 90
41	0 85	0 20	83	0 80	0 65	125	0 75	0 75	167	0 85	1 00	209	0 80	0 90
42	0 95	0 70	84	0 65	0 70	126	0 65	0 70	168	0 70	0 80			

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Appendix 5f: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K6

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.35	0.80	43	0.65	0.50	85	0.35	0.15	127	0.60	0.60	169	0.40	0.40
2	0.70	0.50	44	0.65	0.50	86	0.80	0.55	128	0.60	0.65	170	0.65	0.55
3	0.60	0.55	45	0.50	0.50	87	0.60	0.60	129	0.60	0.60	171	0.60	0.45
4	0.50	0.65	46	0.50	0.65	88	0.80	0.75	130	0.55	0.60	172	0.75	0.15
5	0.65	0.50	47	0.65	0.65	89	0.65	0.60	131	0.65	0.90	173	0.70	0.60
6	0.65	0.55	48	0.65	0.50	90	0.75	0.75	132	0.55	0.45	174	0.50	0.35
7	0.70	0.75	49	0.65	0.45	91	0.60	0.80	133	0.30	0.50	175	0.60	0.60
8	0.75	0.70	50	0.60	0.50	92	0.60	0.65	134	0.60	0.60	176	0.65	0.00
9	0.70	0.70	51	0.65	0.65	93	0.70	0.60	135	0.65	0.60	177	0.75	0.45
10	0.55	0.70	52	0.45	0.50	94	0.75	0.70	136	0.60	0.60	178	0.75	0.40
11	0.50	0.65	53	0.60	0.70	95	0.75	0.70	137	0.50	0.65	179	0.70	0.55
12	0.60	0.75	54	0.60	0.70	96	0.80	0.70	138	0.55	0.95	180	0.65	0.60
13	0.65	0.75	55	0.60	0.70	97	0.60	0.75	139	0.60	0.30	181	0.55	0.40
14	0.65	0.55	56	0.50	0.60	98	0.65	0.70	140	0.05	0.55	182	0.50	0.50
15	0.60	0.60	57	0.65	0.65	99	0.55	0.00	141	0.75	0.55	183	0.70	0.50
16	0.60	0.55	58	0.65	0.45	100	0.15	0.50	142	0.60	0.50	184	0.80	0.40
17	0.60	0.55	59	0.70	0.60	101	0.55	0.70	143	0.45	0.60	185	0.80	0.40
18	0.65	0.35	60	0.70	0.70	102	0.55	0.55	144	0.25	0.95	186	0.60	0.45
19	0.55	0.45	61	0.60	0.65	103	0.65	0.65	145	0.00	0.40	187	0.75	0.30
20	0.55	0.50	62	0.65	0.75	104	0.60	0.55	146	0.50	0.55	188	0.60	0.60
21	0.70	0.55	63	0.75	0.75	105	0.60	0.65	147	0.60	0.55	189	0.35	0.75
22	0.60	0.55	64	0.70	0.80	106	0.65	0.75	148	0.50	0.00	190	0.15	0.70
23	0.60	0.55	65	0.60	0.75	107	0.55	0.15	149	0.15	0.50	191	0.35	0.45
24	0.45	0.65	66	0.65	0.70	108	0.00	0.10	150	0.45	0.50	192	0.70	0.50
25	0.55	0.50	67	0.75	0.75	109	0.00	0.60	151	0.45	0.65	193	0.60	0.55
26	0.70	0.55	68	0.60	0.60	110	0.00	0.65	152	0.15	0.20	194	0.65	0.85
27	0.65	0.65	69	0.70	0.65	111	0.75	0.70	153	0.45	0.40	195	0.35	0.60
28	0.60	0.60	70	0.65	0.55	112	0.60	0.70	154	0.50	0.50	196	0.45	0.55
29	0.65	0.55	71	0.75	0.65	113	0.55	0.55	155	0.60	0.45	197	0.65	0.70
30	0.50	0.65	72	0.80	0.65	114	0.65	0.50	156	0.55	0.35	198	0.60	0.00
31	0.60	0.85	73	0.70	0.30	115	0.65	0.60	157	0.60	0.45	199	0.45	0.00
32	0.65	0.65	74	0.90	0.35	116	0.60	0.50	158	0.55	0.45	200	0.95	0.60
33	0.55	0.65	75	0.80	0.55	117	0.55	0.60	159	0.55	0.55	201	0.70	0.60
34	0.60	0.60	76	0.75	0.50	118	0.65	0.60	160	0.65	0.45	202	0.45	0.15
35	0.65	0.55	77	0.85	0.50	119	0.60	0.50	161	0.70	0.45	203	0.15	0.55
36	0.65	0.45	78	0.75	0.65	120	0.60	0.55	162	0.60	0.65	204	0.00	0.45
37	0.65	0.50	79	0.55	0.50	121	0.60	0.20	163	0.75	0.60	205	0.50	0.50
38	0.30	0.55	80	0.70	0.50	122	0.85	0.40	164	0.80	0.65	206	0.70	0.50
39	0.30	0.00	81	0.70	0.55	123	0.80	0.45	165	0.80	0.55	207	0.70	0.60
40	0.00	0.60	82	0.70	0.55	124	0.50	0.50	166	0.80	0.60	208	0.70	0.65
41	0.35	0.50	83	0.70	0.60	125	0.60	0.80	167	0.70	0.70	209	0.75	0.80
42	0.35	0.40	84	0.65	0.65	126	0.50	0.75	168	0.60	0.60			

ppendix 5g: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K7

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.25	0.60	43	0.45	0.35	85	0.25	0.05	127	0.40	0.40	169	0.25	0.25
2	0.50	0.35	44	0.50	0.40	86	0.60	0.40	128	0.45	0.45	170	0.45	0.40
3	0.45	0.35	45	0.35	0.35	87	0.40	0.45	129	0.45	0.45	171	0.45	0.30
4	0.35	0.45	46	0.40	0.45	88	0.65	0.55	130	0.40	0.40	172	0.55	0.10
5	0.45	0.40	47	0.45	0.45	89	0.50	0.50	131	0.50	0.70	173	0.50	0.40
6	0.45	0.45	48	0.50	0.40	90	0.55	0.50	132	0.40	0.35	174	0.35	0.20
7	0.50	0.55	49	0.45	0.30	91	0.40	0.60	133	0.15	0.40	175	0.40	0.40
8	0.55	0.50	50	0.40	0.40	92	0.45	0.50	134	0.40	0.45	176	0.45	0.00
9	0.55	0.55	51	0.45	0.45	93	0.50	0.40	135	0.55	0.40	177	0.55	0.30
10	0.40	0.50	52	0.30	0.35	94	0.55	0.50	136	0.40	0.40	178	0.55	0.25
11	0.35	0.45	53	0.40	0.50	95	0.60	0.50	137	0.35	0.45	179	0.55	0.40
12	0.45	0.55	54	0.40	0.50	96	0.60	0.55	138	0.40	0.65	180	0.50	0.45
13	0.40	0.60	55	0.40	0.40	97	0.45	0.60	139	0.40	0.10	181	0.40	0.25
14	0.40	0.40	56	0.35	0.40	98	0.45	0.55	140	0.00	0.45	182	0.35	0.35
15	0.45	0.40	57	0.50	0.35	99	0.45	0.00	141	0.55	0.40	183	0.50	0.40
16	0.40	0.35	58	0.45	0.50	100	0.05	0.35	142	0.40	0.35	184	0.60	0.30
17	0.45	0.40	59	0.50	0.50	101	0.40	0.50	143	0.20	0.40	185	0.60	0.25
18	0.50	0.10	60	0.50	0.45	102	0.35	0.35	144	0.15	0.75	186	0.55	0.30
19	0.40	0.30	61	0.40	0.55	103	0.45	0.45	145	0.00	0.25	187	0.55	0.15
20	0.40	0.40	62	0.45	0.55	104	0.40	0.40	146	0.35	0.40	188	0.40	0.45
21	0.50	0.40	63	0.55	0.60	105	0.45	0.40	147	0.40	0.40	189	0.25	0.55
22	0.45	0.35	64	0.50	0.55	106	0.45	0.60	148	0.35	0.00	190	0.00	0.50
23	0.45	0.40	65	0.40	0.60	107	0.35	0.00	149	0.05	0.35	191	0.15	0.25
24	0.30	0.50	66	0.45	0.55	108	0.00	0.00	150	0.30	0.30	192	0.55	0.40
25	0.40	0.35	67	0.55	0.50	109	0.00	0.45	151	0.35	0.45	193	0.40	0.45
26	0.50	0.40	68	0.40	0.45	110	0.00	0.45	152	0.00	0.10	194	0.50	0.65
27	0.45	0.45	69	0.50	0.35	111	0.55	0.50	153	0.20	0.25	195	0.10	0.45
28	0.40	0.40	70	0.45	0.45	112	0.45	0.50	154	0.35	0.30	196	0.30	0.35
29	0.50	0.40	71	0.55	0.45	113	0.40	0.35	155	0.45	0.30	197	0.45	0.50
30	0.35	0.45	72	0.60	0.10	114	0.45	0.35	156	0.40	0.25	198	0.40	0.00
31	0.40	0.65	73	0.50	0.15	115	0.45	0.40	157	0.45	0.30	199	0.30	0.00
32	0.50	0.50	74	0.70	0.45	116	0.40	0.35	158	0.45	0.30	200	0.70	0.40
33	0.40	0.55	75	0.60	0.30	117	0.35	0.40	159	0.45	0.45	201	0.50	0.45
34	0.40	0.45	76	0.55	0.35	118	0.45	0.45	160	0.50	0.35	202	0.30	0.00
35	0.50	0.35	77	0.65	0.35	119	0.45	0.35	161	0.55	0.35	203	0.00	0.35
36	0.45	0.35	78	0.55	0.45	120	0.40	0.40	162	0.40	0.45	204	0.00	0.30
37	0.50	0.35	79	0.40	0.35	121	0.40	0.10	163	0.55	0.45	205	0.30	0.35
38	0.20	0.40	80	0.50	0.30	122	0.65	0.25	164	0.60	0.45	206	0.50	0.35
39	0.15	0.00	81	0.50	0.45	123	0.60	0.30	165	0.60	0.40	207	0.55	0.40
40	0.00	0.40	82	0.50	0.35	124	0.35	0.55	166	0.65	0.40	208	0.50	0.45
41	0.20	0.35	83	0.55	0.40	125	0.45	0.60	167	0.55	0.50	209	0.55	0.60
42	0.20	0.25	84	0.45	0.45	126	0.35	0.55	168	0.45	0.35			

Appendix 5h: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K 8

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.15	0.40	43	0.35	0.25	85	0.25	0.00	127	0.20	0.20	169	0.15	0.15
2	0.40	0.20	44	0.35	0.20	86	0.50	0.20	128	0.25	0.25	170	0.35	0.25
3	0.35	0.20	45	0.20	0.20	87	0.30	0.25	129	0.25	0.20	171	0.35	0.10
4	0.25	0.30	46	0.30	0.25	88	0.30	0.30	130	0.20	0.20	172	0.40	0.00
5	0.35	0.25	47	0.30	0.25	89	0.20	0.30	131	0.35	0.50	173	0.40	0.25
6	0.35	0.30	48	0.40	0.20	90	0.25	0.30	132	0.20	0.20	174	0.25	0.05
7	0.40	0.40	49	0.35	0.10	91	0.30	0.40	133	0.00	0.20	175	0.30	0.20
8	0.45	0.35	50	0.30	0.20	92	0.40	0.30	134	0.20	0.25	176	0.35	0.00
9	0.45	0.40	51	0.35	0.25	93	0.40	0.20	135	0.35	0.20	177	0.40	0.15
10	0.30	0.35	52	0.20	0.15	94	0.45	0.35	136	0.20	0.15	178	0.40	0.10
11	0.25	0.30	53	0.30	0.30	95	0.25	0.30	137	0.20	0.25	179	0.40	0.20
12	0.35	0.40	54	0.30	0.30	96	0.30	0.35	138	0.20	0.45	180	0.40	0.25
13	0.30	0.45	55	0.20	0.20	97	0.20	0.40	139	0.20	0.00	181	0.30	0.10
14	0.25	0.25	56	0.35	0.25	98	0.00	0.40	140	0.00	0.25	182	0.45	0.20
15	0.35	0.20	57	0.30	0.20	99	0.20	0.00	141	0.35	0.20	183	0.40	0.25
16	0.25	0.20	58	0.35	0.35	100	0.20	0.15	142	0.20	0.15	184	0.40	0.25
17	0.35	0.25	59	0.35	0.30	101	0.25	0.30	143	0.05	0.20	185	0.40	0.15
18	0.40	0.00	60	0.30	0.30	102	0.20	0.20	144	0.10	0.60	186	0.25	0.20
19	0.30	0.10	61	0.40	0.40	103	0.25	0.25	145	0.00	0.15	187	0.10	0.00
20	0.30	0.25	62	0.35	0.35	104	0.20	0.20	146	0.15	0.20	188	0.00	0.25
21	0.40	0.25	63	0.25	0.40	105	0.25	0.20	147	0.20	0.15	189	0.05	0.35
22	0.35	0.20	64	0.30	0.45	106	0.20	0.20	148	0.15	0.00	190	0.35	0.35
23	0.35	0.20	65	0.40	0.40	107	0.20	0.00	149	0.00	0.15	191	0.25	0.10
24	0.20	0.35	66	0.25	0.40	108	0.00	0.00	150	0.15	0.15	192	0.30	0.20
25	0.30	0.20	67	0.35	0.35	109	0.00	0.25	151	0.20	0.30	193	0.20	0.30
26	0.40	0.25	68	0.25	0.20	110	0.00	0.25	152	0.00	0.00	194	0.40	0.45
27	0.35	0.35	69	0.35	0.20	111	0.35	0.30	153	0.10	0.05	195	0.00	0.25
28	0.30	0.20	70	0.45	0.25	112	0.25	0.30	154	0.15	0.10	196	0.10	0.10
29	0.40	0.20	71	0.35	0.30	113	0.25	0.15	155	0.30	0.10	197	0.25	0.30
30	0.25	0.25	72	0.50	0.00	114	0.25	0.15	156	0.20	0.05	198	0.20	0.00
31	0.25	0.40	73	0.45	0.05	115	0.25	0.20	157	0.30	0.10	199	0.15	0.00
32	0.40	0.30	74	0.40	0.30	116	0.20	0.20	158	0.30	0.10	200	0.50	0.20
33	0.30	0.35	75	0.50	0.15	117	0.20	0.20	159	0.25	0.25	201	0.35	0.25
34	0.30	0.30	76	0.35	0.20	118	0.30	0.30	160	0.35	0.15	202	0.15	0.00
35	0.35	0.25	77	0.20	0.50	119	0.30	0.20	161	0.40	0.15	203	0.00	0.15
36	0.30	0.25	78	0.35	0.15	120	0.20	0.20	162	0.20	0.25	204	0.00	0.10
37	0.40	0.20	79	0.35	0.25	121	0.20	0.00	163	0.35	0.25	205	0.20	0.20
38	0.10	0.20	80	0.40	0.15	122	0.45	0.10	164	0.40	0.20	206	0.35	0.15
39	0.00	0.00	81	0.40	0.35	123	0.40	0.10	165	0.40	0.25	207	0.40	0.20
40	0.00	0.20	82	0.30	0.15	124	0.15	0.35	166	0.45	0.35	208	0.30	0.40
41	0.10	0.20	83	0.20	0.25	125	0.25	0.40	167	0.40	0.20	209	0.40	0.20
42	0.05	0.05	84	0.35	0.25	126	0.20	0.35	168	0.25	0.15			

Appendix 5i: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw K 9

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.05	0.20	43	0.20	0.10	85	0.15	0.00	127	0.10	0.10	169	0.05	0.05
2	0.15	0.10	44	0.20	0.15	86	0.30	0.00	128	0.15	0.05	170	0.20	0.10
3	0.15	0.05	45	0.10	0.15	87	0.15	0.05	129	0.15	1.00	171	0.20	0.00
4	0.10	0.10	46	0.15	0.10	88	0.20	0.10	130	0.10	0.10	172	0.30	0.00
5	0.15	0.10	47	0.15	0.10	89	0.10	0.20	131	0.15	0.30	173	0.30	0.10
6	0.25	0.15	48	0.20	0.05	90	0.15	0.10	132	0.10	0.10	174	0.10	0.00
7	0.25	0.20	49	0.25	0.00	91	0.20	0.30	133	0.00	0.10	175	0.15	0.10
8	0.30	0.15	50	0.15	0.00	92	0.30	0.20	134	0.10	0.15	176	0.20	0.00
9	0.20	0.25	51	0.25	0.15	93	0.25	0.10	135	0.15	0.10	177	0.25	0.00
10	0.10	0.15	52	0.10	0.00	94	0.30	0.20	136	0.10	0.00	178	0.25	0.00
11	0.15	0.10	53	0.15	0.15	95	0.10	0.10	137	0.10	0.15	179	0.25	0.05
12	0.25	0.25	54	0.20	0.15	96	0.15	0.20	138	0.05	0.30	180	0.25	0.15
13	0.15	0.30	55	0.10	0.10	97	0.10	0.20	139	0.05	0.00	181	0.20	0.10
14	0.15	0.10	56	0.20	0.10	98	0.00	0.20	140	0.00	0.15	182	0.25	0.00
15	0.25	0.05	57	0.15	0.10	99	0.05	0.00	141	0.25	0.00	183	0.20	0.15
16	0.15	0.10	58	0.20	0.20	100	0.05	0.00	142	0.10	0.00	184	0.20	0.15
17	0.20	0.10	59	0.20	0.15	101	0.10	0.20	143	0.00	0.10	185	0.25	0.00
18	0.30	0.00	60	0.20	0.10	102	0.10	0.05	144	0.00	0.40	186	0.15	0.10
19	0.15	0.00	61	0.30	0.20	103	0.15	0.15	145	0.00	0.05	187	0.00	0.00
20	0.10	0.10	62	0.20	0.15	104	0.05	0.05	146	0.05	0.10	188	0.00	0.15
21	0.30	0.15	63	0.15	0.25	105	0.15	0.10	147	0.10	0.05	189	0.00	0.20
22	0.20	0.10	64	0.15	0.30	106	0.10	0.10	148	0.05	0.00	190	0.20	0.20
23	0.20	0.05	65	0.30	0.20	107	0.05	0.00	149	0.00	0.05	191	0.10	0.00
24	0.10	0.15	66	0.10	0.25	108	0.00	0.00	150	0.05	0.00	192	0.10	0.10
25	0.10	0.10	67	0.20	0.20	109	0.00	0.10	151	0.00	0.10	193	0.10	0.15
26	0.30	0.10	68	0.10	0.05	110	0.00	0.05	152	0.00	0.00	194	0.20	0.30
27	0.20	0.15	69	0.25	0.10	111	0.15	0.15	153	0.05	0.00	195	0.00	0.15
28	0.15	0.05	70	0.25	0.00	112	0.15	0.20	154	0.15	0.05	196	0.00	0.00
29	0.30	0.10	71	0.15	0.15	113	0.15	0.00	155	0.10	0.00	197	0.15	0.10
30	0.15	0.05	72	0.35	0.00	114	0.10	0.00	156	0.15	0.00	198	0.10	0.00
31	0.15	0.20	73	0.30	0.00	115	0.15	0.10	157	0.20	0.10	199	0.05	0.00
32	0.30	0.15	74	0.30	0.10	116	0.10	0.05	158	0.15	0.05	200	0.30	0.10
33	0.20	0.20	75	0.25	0.00	117	0.10	0.00	159	0.20	0.10	201	0.25	0.15
34	0.20	0.10	76	0.20	0.05	118	0.15	0.20	160	0.25	0.05	202	0.05	0.00
35	0.25	0.15	77	0.10	0.30	119	0.15	0.10	161	0.10	0.05	203	0.00	0.00
36	0.20	0.10	78	0.20	0.05	120	0.10	0.05	162	0.20	0.10	204	0.00	0.00
37	0.30	0.05	79	0.20	0.10	121	0.05	0.00	163	0.20	0.15	205	0.10	0.10
38	0.00	0.00	80	0.25	0.00	122	0.30	0.00	164	0.25	0.00	206	0.20	0.05
39	0.00	0.00	81	0.25	0.15	123	0.40	0.00	165	0.30	0.10	207	0.30	0.10
40	0.00	0.00	82	0.10	0.00	124	0.00	0.20	166	0.25	0.20	208	0.30	0.20
41	0.05	0.10	83	0.10	0.05	125	0.10	0.30	167	0.10	0.10	209	0.25	0.25
42	0.00	0.00	84	0.20	0.05	126	0.10	0.15	168	0.20	0.00			

Appendix 6a: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L1

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.90	1.30	43	1.45	1.20	85	1.20	1.20	127	1.30	0.95	169	1.40	1.10
2	0.85	1.15	44	1.20	1.20	86	1.20	1.10	128	1.30	0.95	170	1.20	0.90
3	0.90	1.10	45	1.15	1.20	87	1.20	1.00	129	1.45	0.95	171	1.25	1.00
4	1.10	1.10	46	1.20	1.20	88	1.10	1.20	130	1.40	1.10	172	1.25	1.20
5	1.10	1.15	47	1.20	1.10	89	1.25	1.10	131	1.35	1.10	173	1.30	1.20
6	1.10	1.20	48	1.10	1.10	90	1.25	1.25	132	1.25	1.15	174	1.25	1.10
7	1.15	1.20	49	1.25	0.95	91	1.25	1.10	133	1.25	1.05	175	1.15	1.05
8	1.25	1.00	50	1.25	0.95	92	1.20	1.10	134	1.25	0.95	176	1.10	1.10
9	1.25	1.00	51	1.30	0.90	93	1.20	1.10	135	1.35	1.00	177	1.25	1.25
10	1.25	1.30	52	1.40	0.90	94	1.20	1.15	136	1.35	1.20	178	1.15	1.25
11	1.10	1.40	53	1.40	0.90	95	1.35	1.20	137	1.30	1.10	179	1.25	1.20
12	1.10	1.40	54	1.40	1.00	96	1.30	1.10	138	1.25	1.20	180	1.20	1.25
13	1.20	1.50	55	1.25	1.10	97	1.20	1.20	139	1.25	1.05	181	1.20	1.10
14	1.05	1.35	56	1.25	1.10	98	1.20	1.30	140	1.25	1.00	182	1.35	1.00
15	1.10	1.25	57	1.25	1.15	99	1.25	1.35	141	1.30	1.15	183	1.45	0.90
16	1.20	1.10	58	1.25	1.35	100	1.15	1.35	142	1.25	0.90	184	1.40	1.00
17	1.20	1.15	59	1.10	1.25	101	1.20	1.25	143	1.30	1.05	185	1.45	0.95
18	1.20	1.30	60	1.10	1.35	102	1.15	1.20	144	1.40	1.00	186	1.40	1.00
19	1.00	1.35	61	1.10	1.30	103	1.20	1.25	145	1.30	0.90	187	1.30	0.95
20	1.05	1.25	62	1.15	1.25	104	1.25	1.10	146	1.30	1.00	188	1.20	1.20
21	1.10	1.05	63	1.15	1.00	105	1.25	1.20	147	1.25	1.10	189	1.25	1.30
22	1.15	1.10	64	1.15	1.00	106	1.30	1.20	148	1.30	1.15	190	1.20	1.45
23	1.20	1.05	65	1.25	1.10	107	1.35	1.15	149	1.25	1.15	191	1.25	1.40
24	1.25	1.15	66	1.30	0.95	108	1.25	1.25	150	1.20	1.20	192	1.40	1.20
25	1.10	1.25	67	1.35	1.00	109	1.35	1.15	151	1.25	1.20	193	1.20	1.10
26	1.05	1.25	68	1.35	1.05	110	1.20	1.10	152	1.25	1.05	194	1.25	1.20
27	1.10	1.25	69	1.30	1.15	111	1.15	1.15	153	1.30	1.10	195	1.25	1.10
28	1.10	1.15	70	1.25	1.00	112	1.25	1.10	154	1.35	1.10	196	1.25	1.00
29	1.10	1.20	71	1.25	1.10	113	1.25	1.05	155	1.25	1.15	197	1.25	1.05
30	1.10	1.20	72	1.30	1.10	114	1.40	1.10	156	1.30	1.15	198	1.20	1.10
31	1.10	1.25	73	1.25	1.10	115	1.30	1.10	157	1.25	1.05	199	1.30	1.05
32	1.00	1.20	74	1.20	1.10	116	1.40	1.20	158	1.25	1.20	200	1.30	1.05
33	1.20	1.00	75	1.20	1.00	117	1.40	1.20	159	1.30	1.15	201	1.35	1.05
34	1.30	1.20	76	1.15	1.15	118	1.35	1.05	160	1.35	1.35	202	1.30	1.00
35	1.20	1.20	77	1.25	1.15	119	1.30	1.00	161	1.30	1.30	203	1.40	1.00
36	1.20	1.20	78	1.30	0.15	120	1.30	1.00	162	1.20	1.40	204	1.40	1.10
37	1.25	1.10	79	1.20	1.20	121	1.35	1.05	163	1.20	1.25	205	1.35	1.20
38	1.20	1.20	80	1.25	0.10	122	1.50	1.00	164	1.35	1.45	206	1.30	1.05
39	1.20	1.10	81	1.25	0.90	123	1.40	1.05	165	1.15	1.50	207	1.20	1.10
40	1.20	1.20	82	0.25	1.05	124	1.40	1.00	166	1.35	1.40	208	1.20	1.10
41	1.20	1.10	83	1.40	0.90	125	1.40	1.00	167	1.25	1.05	209	1.20	1.15
42	1.25	1.05	84	1.30	1.10	126	1.30	1.10	168	1.15	1.20			

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Appendix 6b: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L2

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	1.10	1.30	43	1.10	1.15	85	0.95	1.25	127	1.40	0.70	169	1.10	0.90
2	0.90	1.40	44	1.10	1.10	86	1.20	0.75	128	1.25	0.85	170	1.15	0.90
3	0.90	1.20	45	1.05	1.05	87	1.05	1.25	129	1.10	1.00	171	0.95	1.05
4	1.10	1.40	46	1.10	1.00	88	1.20	1.00	130	1.10	1.00	172	1.00	1.00
5	1.05	1.10	47	1.00	1.10	89	1.00	1.20	131	1.20	1.00	173	1.20	1.00
6	1.15	1.10	48	1.25	0.85	90	1.10	1.10	132	1.15	1.05	174	1.10	1.10
7	1.10	1.20	49	1.05	1.10	91	1.10	1.00	133	1.30	0.90	175	1.10	1.00
8	1.20	1.05	50	1.25	0.90	92	1.30	0.90	134	1.15	1.00	176	1.05	1.20
9	1.10	1.20	51	1.35	0.80	93	1.15	1.05	135	1.10	1.15	177	1.10	1.20
10	1.10	1.25	52	1.25	0.95	94	1.15	0.95	136	1.15	1.05	178	1.15	1.00
11	0.85	1.50	53	1.25	0.95	95	1.20	1.00	137	1.05	1.05	179	1.25	1.10
12	1.20	1.05	54	1.15	1.00	96	1.10	1.15	138	1.10	1.05	180	1.15	1.00
13	0.95	1.25	55	1.15	1.05	97	1.10	1.05	139	1.15	0.90	181	1.20	1.00
14	1.00	1.15	56	1.10	1.20	98	1.00	1.20	140	1.15	1.00	182	1.35	0.85
15	1.20	1.10	57	1.05	1.25	99	0.90	1.30	141	1.10	1.00	183	1.20	1.00
16	0.95	1.20	58	1.05	1.25	100	1.15	0.95	142	1.20	0.85	184	1.40	0.85
17	1.15	0.95	59	1.05	1.25	101	1.05	1.15	143	1.15	1.10	185	1.25	1.05
18	0.85	1.30	60	0.95	1.30	102	1.20	1.00	144	1.05	1.00	186	1.15	1.15
19	1.10	1.15	61	1.05	1.10	103	1.10	1.05	145	1.20	1.00	187	0.85	1.10
20	1.10	1.05	62	1.15	1.05	104	1.15	0.95	146	1.20	1.05	188	1.10	1.20
21	0.85	1.30	63	1.20	0.90	105	1.10	0.95	147	1.15	1.05	189	1.10	1.10
22	1.15	1.00	64	1.15	0.95	106	1.10	0.95	148	1.15	1.20	190	1.00	1.20
23	1.10	1.10	65	1.30	0.80	107	1.15	1.05	149	0.90	1.15	191	1.20	1.00
24	1.05	1.20	66	1.10	1.05	108	1.00	1.10	150	1.00	1.25	192	1.30	0.85
25	0.95	1.30	67	1.20	0.95	109	1.10	1.00	151	1.05	1.15	193	1.25	1.00
26	0.90	1.35	68	0.85	1.25	110	1.00	1.15	152	1.20	1.05	194	1.35	0.85
27	0.90	1.35	69	1.25	0.85	111	1.20	0.90	153	1.15	1.00	195	1.10	0.90
28	0.90	1.05	70	1.10	1.05	112	1.00	1.05	154	1.20	1.20	196	1.15	1.10
29	1.10	1.05	71	1.10	0.95	113	1.30	0.90	155	1.25	1.05	197	1.05	1.10
30	0.95	1.25	72	1.10	0.95	114	1.10	0.05	156	1.30	1.10	198	1.10	1.10
31	0.95	1.05	73	0.90	1.15	115	1.10	1.10	157	1.30	1.00	199	1.35	0.85
32	1.00	1.05	74	1.10	0.95	116	1.15	1.00	158	1.20	1.05	200	1.30	0.90
33	1.15	0.90	75	1.15	1.00	117	1.05	1.10	159	1.10	1.10	201	1.30	0.95
34	1.05	1.05	76	1.10	0.90	118	1.25	0.80	160	1.05	1.10	202	1.25	1.00
35	1.05	1.05	77	1.05	1.15	119	1.20	1.05	161	1.25	1.10	203	1.35	0.90
36	1.15	1.00	78	1.10	0.95	120	1.25	0.90	162	1.10	1.10	204	1.25	0.95
37	0.90	1.15	79	1.10	1.00	121	1.30	0.90	163	1.20	1.45	205	1.30	0.90
38	1.20	1.00	80	1.25	0.90	122	1.20	0.95	164	1.10	1.25	206	1.15	1.05
39	1.10	1.10	81	1.10	0.90	123	1.15	1.00	165	1.15	1.35	207	1.35	0.85
40	1.00	1.25	82	1.25	0.80	124	1.10	0.95	166	1.05	1.35	208	1.15	1.00
41	1.20	0.95	83	1.00	1.10	125	1.15	1.05	167	1.05	1.30	209	1.05	1.10
42	1.25	1.00	84	1.10	0.95	126	1.10	0.95	168	1.10	1.20			

Appendix 6c: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L3

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.60	1.15	43	1.05	0.60	85	0.90	0.90	127	1.00	0.45	169	0.95	0.80
2	0.55	0.90	44	0.80	0.90	86	0.70	0.65	128	1.05	0.55	170	1.00	0.65
3	0.65	0.85	45	0.75	0.90	87	0.90	0.80	129	0.90	0.55	171	0.55	0.70
4	0.70	0.90	46	0.75	0.90	88	0.80	0.75	130	0.90	0.70	172	0.80	0.65
5	0.70	0.90	47	0.90	0.80	89	0.90	0.80	131	0.85	0.70	173	0.80	0.65
6	0.80	0.90	48	0.85	0.75	90	0.70	0.80	132	0.90	0.75	174	0.90	0.60
7	0.85	0.75	49	0.80	0.75	91	0.80	0.75	133	0.90	0.60	175	0.85	0.75
8	0.90	0.75	50	0.80	0.80	92	0.80	0.65	134	1.05	0.60	176	0.80	0.80
9	0.85	0.65	51	0.95	0.70	93	0.95	0.80	135	0.90	0.80	177	0.85	0.90
10	0.85	0.85	52	1.00	0.55	94	0.85	0.70	136	0.90	0.75	178	0.85	0.70
11	0.70	0.95	53	0.90	0.65	95	0.85	0.70	137	0.90	0.75	179	0.90	0.70
12	0.60	0.95	54	0.90	0.70	96	0.75	0.90	138	0.85	0.75	180	0.95	0.80
13	0.90	0.80	55	0.85	0.70	97	0.80	0.70	139	0.80	0.65	181	0.85	0.70
14	0.85	0.90	56	0.95	0.75	98	0.80	0.90	140	0.85	0.75	182	1.05	0.60
15	0.75	0.90	57	0.90	0.65	99	0.80	0.85	141	0.85	0.55	183	1.00	0.75
16	0.80	0.90	58	0.75	0.90	100	0.65	0.85	142	0.85	0.55	184	1.05	0.40
17	0.85	0.95	59	0.80	0.80	101	0.80	0.90	143	1.00	0.80	185	1.10	0.35
18	0.70	0.90	60	0.80	0.85	102	0.85	0.80	144	0.85	0.50	186	1.00	0.65
19	1.10	0.65	61	1.00	0.65	103	0.80	0.85	145	0.85	0.45	187	1.00	0.80
20	0.80	0.95	62	0.80	0.70	104	0.80	0.75	146	1.05	0.55	188	0.85	0.90
21	0.80	0.90	63	0.90	0.65	105	0.90	0.75	147	1.00	0.95	189	0.85	0.95
22	0.70	0.95	64	0.85	0.70	106	0.80	0.80	148	0.75	0.55	190	0.80	0.90
23	0.85	0.85	65	0.90	0.65	107	0.80	0.80	149	1.05	1.00	191	0.75	0.65
24	0.80	0.85	66	1.00	0.55	108	0.85	0.95	150	0.65	0.65	192	1.10	0.50
25	0.75	0.95	67	0.80	0.75	109	0.75	0.80	151	0.85	0.90	193	0.55	1.00
26	0.70	1.05	68	0.85	0.65	110	0.85	0.75	152	0.70	0.80	194	1.50	0.55
27	0.65	0.95	69	0.70	1.00	111	0.80	0.65	153	0.80	0.60	195	0.90	0.65
28	0.65	0.85	70	0.90	0.70	112	1.00	0.80	154	0.90	0.85	196	0.95	0.75
29	0.50	0.95	71	0.75	0.85	113	0.90	0.65	155	0.80	0.75	197	1.00	0.65
30	0.65	0.85	72	0.80	0.85	114	0.95	0.75	156	0.80	0.85	198	0.95	0.80
31	0.50	0.90	73	0.80	0.85	115	0.90	0.65	157	0.85	0.75	199	0.85	0.65
32	0.65	0.80	74	0.75	0.95	116	0.90	0.75	158	1.00	0.90	200	0.90	0.60
33	0.70	0.75	75	0.80	0.85	117	0.85	0.85	159	0.85	0.90	201	1.00	0.50
34	0.70	0.75	76	0.80	0.90	118	0.65	0.65	160	0.80	0.90	202	1.10	0.70
35	0.65	0.85	77	0.80	0.75	119	0.90	0.85	161	0.80	0.70	203	1.05	0.50
36	0.75	0.75	78	0.70	0.85	120	0.90	0.65	162	0.95	0.95	204	0.95	0.60
37	0.55	0.75	79	0.80	0.75	121	0.90	0.60	163	0.95	0.65	205	0.95	0.60
38	0.65	0.90	80	0.90	0.75	122	0.95	1.70	164	1.00	0.80	206	1.05	0.85
39	0.60	0.85	81	1.00	0.60	123	0.90	0.60	165	0.90	0.80	207	0.75	0.45
40	0.75	0.95	82	0.55	0.25	124	0.85	0.50	166	0.95	0.80	208	1.00	0.75
41	0.70	0.95	83	1.15	0.40	125	0.90	0.55	167	0.85	0.80	209	0.90	0.55
42	0.80	0.85	84	0.85	0.80	126	0.95	0.65	168	0.85	0.90			

Appendix 6d: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L4

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.55	1 10	43	1.00	0.40	85	0.90	0.60	127	0.75	0.60	169	0.65	0.80
2	0.55	0 85	44	1.00	0.45	86	0.80	0.50	128	0.90	0.40	170	0.70	0.70
3	0.65	0.85	45	0.80	0.70	87	0.75	0.80	129	1.00	0.60	171	0.75	0.50
4	0.65	0.90	46	0.75	0.75	88	0.90	0.50	130	0.85	0.50	172	0.65	0.55
5	0.65	0.90	47	0.75	0.80	89	0.75	0.60	131	0 80	0.55	173	0.65	0.55
6	0.60	0.90	48	0.80	0.75	90	0.85	0.60	132	0.80	0.60	174	0.75	0.70
7	0.65	0.80	49	0.75	0.60	91	0.75	0.65	133	0 80	0 50	175	0.80	0.60
8	0.70	0.75	50	0.80	0.75	92	0.75	0.60	134	0 80	0.55	176	0.75	0.75
9	0.80	0.60	51	0.80	0.65	93	0.75	0.55	135	0.95	0.40	177	0.70	0.75
10	0.85	0.60	52	0.90	0.60	94	0.85	0.45	136	0.85	0 45	178	0.65	0.75
11	0 80	0.70	53	1.00	0.40	95	0.80	0.65	137	0 85	0.55	179	0.70	0.75
12	0 75	0 85	54	0.90	0.65	96	0.85	0.60	138	0 85	0 60	180	0 85	0.60
13	0.90	0 75	55	0.90	0.65	97	0.85	0.60	139	0.75	0.55	181	0.90	0.60
14	0 75	0.75	56	0.85	0 70	98	0.75	0 85	140	0 75	0 65	182	0.95	0 55
15	0.70	0.80	57	0.90	0.70	99	0.75	0.65	141	0 85	0.55	183	0.90	0 65
16	0.75	0.75	58	0.80	0.65	100	0.75	0.70	142	0 85	0 55	184	0.95	0.60
17	0 65	0 90	59	0 65	0 85	101	0.65	0 80	143	0 85	0 35	185	1.05	0 35
18	0.70	0 85	60	0.75	0.75	102	0.80	0 75	144	0 90	0 40	186	0.85	0.70
19	0.90	0 55	61	0.70	0.60	103	0.85	0.75	145	0 80	0.70	187	0.75	0.75
20	0.70	0 85	62	0.85	0.80	104	0.80	0 70	146	0 75	0 60	188	0.65	0.80
21	0 75	0.75	63	0.75	0.75	105	0.85	0.70	147	0.90	0.60	189	0.50	0.90
22	0.65	0.80	64	0.90	0.65	106	0.90	0.70	148	0 90	0.30	190	0.60	0.85
23	0 75	0.80	65	0.80	0.65	107	0.80	0.60	149	0 70	0.65	191	0.05	0.40
24	0 85	0.75	66	0.90	0.70	108	0.80	0.65	150	1 00	0 45	192	0 65	0.65
25	0 75	0 75	67	1 00	0 45	109	0.80	0 65	151	0 55	0.80	193	0.90	0 50
26	0.65	0 90	68	0.80	0.60	110	0.70	0.80	152	0 85	0 35	194	0.55	0.90
27	0 65	0 80	69	0.80	0.55	111	0.90	0.65	153	0 70	0 80	195	0.70	0.70
28	0 65	0.70	70	0.65	0.85	112	0.80	0.75	154	0 70	0.65	196	0.75	0.70
29	0.65	0 85	71	0.85	0.60	113	1.00	0.45	155	0.80	0.65	197	0.80	0.55
30	0.60	0.80	72	0.70	0.75	114	0.75	0.70	156	0 70	0.60	198	0.75	0.75
31	0.50	0 80	73	0.70	0.60	115	1.00	0.55	157	0 75	0.50	199	0.80	0.55
32	0 55	0.70	74	0.80	0.60	116	0.95	0.55	158	0 80	0 50	200	0.70	0 65
33	0 60	0 70	75	0.70	0 85	117	0.90	0 55	159	0 90	0 45	201	0.75	0.70
34	0.65	0 65	76	0.75	0.70	118	0.90	0.80	160	0 80	0 50	202	0 85	0.60
35	0.65	0 75	77	0 75	0.75	119	0.55	0 90	161	0 75	0 75	203	0.90	0 50
36	0.90	0.65	78	0.75	0.60	120	0.80	0 60	162	0 60	0.80	204	0.85	0.50
37	0.90	0.65	79	0.70	0.65	121	0.75	0.75	163	0 80	0.90	205	0.90	0 45
38	0.75	0.70	80	0.80	0.60	122	0.80	0.60	164	0 75	0.60	206	0.90	0.35
39	0.90	0.75	81	0.85	0.40	123	0.90	0.55	165	0.85	0.80	207	1.05	0.40
40	0.75	0.75	82	0.90	0.45	124	0.85	0.50	166	0 75	0.60	208	0.75	0.70
41	0.70	0 80	83	0.25	0.30	125	0.70	0.65	167	0 80	0.70	209	0.90	0.35
42	0.75	0.60	84	0.85	0.50	126	0.80	0.45	168	0 75	0.65			

Appendix 6e: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L5

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No.	Out	In
1	0.55	0.85	43	0.90	0.10	85	0.75	0.40	127	0.75	0.20	169	0.60	0.50
2	0.50	0.75	44	0.90	0.30	86	0.70	0.45	128	0.90	0.25	170	0.60	0.40
3	0.50	0.70	45	0.70	0.60	87	0.55	0.65	129	0.95	0.35	171	0.65	0.50
4	0.40	0.75	46	0.65	0.60	88	0.80	0.40	130	0.85	0.55	172	0.65	0.60
5	0.50	0.75	47	0.65	0.70	89	0.70	0.55	131	0.65	0.45	173	0.60	0.65
6	0.60	0.70	48	0.70	0.40	90	0.80	0.50	132	0.65	0.50	174	0.65	0.50
7	0.70	0.60	49	0.65	0.50	91	0.60	0.60	133	0.70	0.45	175	0.70	0.45
8	0.60	0.70	50	0.60	0.50	92	0.70	0.45	134	0.70	0.40	176	0.70	0.45
9	0.75	0.55	51	0.70	0.50	93	0.60	0.50	135	0.85	0.35	177	0.65	0.55
10	0.65	0.65	52	0.80	0.30	94	0.80	0.40	136	0.80	0.45	178	0.60	0.55
11	0.70	0.65	53	0.90	0.10	95	0.70	0.40	137	0.80	0.50	179	0.55	0.55
12	0.50	0.95	54	0.75	0.30	96	0.70	0.55	138	0.80	0.55	180	0.70	0.45
13	0.75	0.60	55	0.80	0.50	97	0.75	0.55	139	0.70	0.40	181	0.70	0.45
14	0.55	0.75	56	0.70	0.50	98	0.60	0.70	140	0.70	0.40	182	0.85	0.30
15	0.60	0.80	57	0.80	0.55	99	0.65	0.60	141	0.75	0.50	183	0.85	0.65
16	0.70	0.75	58	0.75	0.30	100	0.65	0.60	142	0.70	0.40	184	0.90	0.55
17	0.65	0.85	59	0.60	0.50	101	0.55	0.65	143	0.70	0.35	185	0.90	0.40
18	0.65	0.80	60	0.65	0.30	102	0.65	0.55	144	0.80	0.40	186	0.85	0.25
19	0.80	0.55	61	0.60	0.45	103	0.75	0.60	145	0.70	0.40	187	0.80	0.35
20	0.60	0.75	62	0.65	0.30	104	0.60	0.75	146	0.75	0.30	188	0.55	0.50
21	0.65	0.70	63	0.60	0.60	105	0.70	0.70	147	0.90	0.30	189	0.50	0.85
22	0.50	0.80	64	0.75	0.45	106	0.70	0.65	148	0.95	0.60	190	0.50	0.75
23	0.70	0.65	65	0.65	0.45	107	0.65	0.65	149	0.65	0.20	191	0.00	0.00
24	0.70	0.60	66	0.70	0.45	108	0.75	0.55	150	0.90	0.55	192	0.55	0.50
25	0.50	0.60	67	0.85	0.35	109	0.70	0.50	151	0.55	0.35	193	0.80	0.40
26	0.55	0.75	68	0.65	0.45	110	0.55	0.60	152	0.75	0.55	194	0.50	0.50
27	0.50	0.75	69	0.70	0.40	111	0.85	0.30	153	0.50	0.55	195	0.65	0.60
28	0.55	0.65	70	0.50	0.60	112	0.80	0.40	154	0.65	0.50	196	0.60	0.65
29	0.40	0.80	71	0.75	0.40	113	0.95	0.35	155	0.50	0.50	197	0.70	0.40
30	0.50	0.65	72	0.60	0.50	114	0.75	0.45	156	0.65	0.45	198	0.75	0.55
31	0.30	0.65	73	0.65	0.60	115	0.90	0.35	157	0.65	0.50	199	0.70	0.45
32	0.40	0.55	74	0.70	0.45	116	0.90	0.25	158	0.60	0.50	200	0.70	0.55
33	0.50	0.60	75	0.60	0.65	117	0.90	0.35	159	0.75	0.05	201	0.70	0.55
34	0.55	0.65	76	0.70	0.50	118	0.75	0.45	160	0.05	0.00	202	0.75	0.35
35	0.55	0.65	77	0.65	0.55	119	0.65	0.60	161	0.15	0.00	203	0.75	0.40
36	0.75	0.50	78	0.70	0.50	120	0.80	0.45	162	0.50	0.50	204	0.85	0.40
37	0.75	0.55	79	0.70	0.40	121	0.75	0.40	163	0.70	0.65	205	0.80	0.40
38	0.55	0.60	80	0.80	0.25	122	0.75	0.40	164	0.65	0.05	206	0.90	0.45
39	0.70	0.60	81	0.85	0.20	123	0.80	0.40	165	0.15	0.60	207	0.85	0.20
40	0.65	0.65	82	0.90	0.20	124	0.75	0.50	166	0.55	0.60	208	1.00	0.45
41	0.65	0.60	83	0.20	0.00	125	0.60	0.40	167	0.60	0.60	209	0.70	0.30
42	0.65	0.65	84	0.75	0.35	126	0.85	0.50	168	0.45	0.45			

Appendix 6f: Inner and Outer Side Clearance (mm) of Stellite Tipped Saw L6

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	0.50	0.85	43	0 85	0.25	85	0.75	0.50	127	0 65	0 20	169	0 55	0 00
2	0.45	0 70	44	0.85	0 30	86	0.70	0.75	128	0 75	0.40	170	0.20	0.20
3	0 50	0 70	45	0 65	0 50	87	0.50	0 35	129	0 85	0.40	171	0.75	0 50
4	0 50	0 65	46	0 65	0.50	88	0 75	0 50	130	0 80	0 55	172	0 60	0 55
5	0 55	0 65	47	0 60	0 60	89	0 65	0 50	131	0 65	0 50	173	0 70	0 60
6	0 60	0.65	48	0.60	0 50	90	0 70	0 60	132	0 70	0 55	174	0 65	0 50
7	0 65	0 60	49	0.60	0 50	91	0 60	0.50	133	0 70	0 35	175	0 55	0 45
8	0.65	0 60	50	0.60	0.60	92	0.65	0 40	134	0 70	0 40	176	0 70	0 50
9	0 75	0.55	51	0.65	0.50	93	0.60	0 30	135	0 80	0 65	177	0 85	0 60
10	0.65	0.55	52	0.80	0.40	94	0.80	0.45	136	0 75	0 60	178	0 75	0 40
11	0.15	0.00	53	0.85	0.35	95	0.65	0.45	137	0 75	0.55	179	0.80	0.35
12	0.50	0.90	54	0.70	0 45	96	0.70	0.45	138	0 75	0.50	180	0.85	0 60
13	0 75	0 60	55	0 80	0.45	97	0.75	0.70	139	0.65	0 50	181	0.90	0 35
14	0.55	0 80	56	0.70	0.55	98	0.60	0.60	140	0 70	0.45	182	0 80	0 60
15	0 60	0.70	57	0 80	0.50	99	0.70	0.60	141	0 70	0 30	183	0.80	0 30
16	0 70	0.65	58	0 70	0 30	100	0.65	0.70	142	0 70	0 20	184	0 65	0 40
17	0.60	0.75	59	0 60	0.45	101	0.50	0.60	143	0 70	0 50	185	0.65	0 40
18	0.65	0 70	60	0.60	0.30	102	0.65	0.65	144	0 80	0 50	186	0.75	0 45
19	0.75	0.45	61	0.60	0.50	103	0.70	0 60	145	0 70	0 30	187	0 70	0 40
20	0 55	0.70	62	0.70	0.35	104	0.70	0.50	146	0 75	0 30	188	0 60	0.60
21	0 60	0 75	63	0.55	0.55	105	0.70	0 55	147	0.90	0 50	189	0.70	0.45
22	0.45	0.80	64	0.75	0.55	106	0.80	0.60	148	0 90	0.05	190	0.70	0.50
23	0.65	0.55	65	0 70	0.40	107	0.70	0.55	149	0 60	0.55	191	0.60	0 55
24	0.70	0.60	66	0.75	0.35	108	0.75	0.40	150	0 90	0 30	192	0 65	0 55
25	0.65	0 60	67	0 85	0.30	109	0.75	0.60	151	0 60	0.60	193	0.55	0.60
26	0.60	0 75	68	0 70	0.35	110	0.60	0 35	152	0 75	0 50	194	0 60	0.40
27	0.50	0 60	69	0 75	0 35	111	0.70	0.60	153	0 60	0 30	195	0 75	0.00
28	0.50	0.60	70	0.55	0.50	112	0.65	0.30	154	0 65	0 40	196	0.25	0.45
29	0.35	0.70	71	0.75	0 40	113	0.80	0.45	155	0 70	0 50	197	0.85	0 35
30	0.50	0.60	72	0.55	0.50	114	0.70	0.40	156	0.65	0 55	198	0.80	0 55
31	0.35	0.60	73	0.60	0.45	115	0.85	0.50	157	0.65	0.00	199	0.70	0.30
32	0.40	0.55	74	0.70	0.60	116	0.70	0.40	158	0 75	0 05	200	0 85	0.35
33	0.50	0 50	75	0.60	0.50	117	0.75	0.35	159	0 70	0.00	201	0.85	0.30
34	0.55	0.50	76	0.65	0.55	118	0.75	0 45	160	0.10	0 00	202	0.90	0.20
35	0.50	0.60	77	0.60	0.50	119	0.65	0.30	161	0.15	0.00	203	0.70	0 20
36	0.70	0.55	78	0.65	0.65	120	0.75	0.35	162	0 00	0.00	204	0 60	0.65
37	0.75	0.40	79	0.60	0.40	121	0.75	0.25	163	0.20	0 00	205	0.55	0.65
38	0.60	0.55	80	0.65	0.40	122	0.80	0.35	164	0.20	0.10	206	0.05	0 00
39	0.70	0.60	81	0.70	0.30	123	0.80	0.40	165	0.20	0 00	207	0.40	0.50
40	0.65	0.55	82	0.80	0.00	124	0.75	0.40	166	0.15	0.85	208	0 80	0.35
41	0.60	0.55	83	0 15	0.30	125	0.65	0.40	167	0 10	0 60	209	0 50	0 70
42	0.65	0.50	84	0.90	0.50	126	0 70	0 60	168	0 45	0 20			

Appendix 6g: Inner and Outer Side Clearance (mm) of Stellite Tipped Saw L7

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In
1	0:40	0.90	43	0.80	0.20	85	0.70	0.35	127	0.65	0.50	169	0.20	0.00
2	0.35	0.70	44	0.10	0.15	86	0.65	0.45	128	0.75	0.25	170	0.30	0.10
3	0.10	0.00	45	0.55	0.40	87	0.50	0.60	129	0.85	0.20	171	0.70	0.40
4	0.40	0.65	46	0.60	0.45	88	0.70	0.35	130	0.75	0.30	172	0.55	0.50
5	0.50	0.60	47	0.55	0.55	89	0.55	0.65	131	0.65	0.40	173	0.65	0.40
6	0.55	0.50	48	0.65	0.40	90	0.70	0.50	132	0.65	0.55	174	0.60	0.50
7	0.60	0.55	49	0.55	0.50	91	0.55	0.55	133	0.70	0.40	175	0.65	0.55
8	0.20	0.05	50	0.60	0.50	92	0.60	0.50	134	0.60	0.50	176	0.65	0.45
9	0.50	0.00	51	0.65	0.45	93	0.60	0.50	135	0.80	0.30	177	0.80	0.35
10	0.50	0.40	52	0.70	0.35	94	0.70	0.30	136	0.75	0.40	178	0.75	0.35
11	0.10	0.00	53	0.80	0.05	95	0.65	0.35	137	0.65	0.55	179	0.80	0.30
12	0.35	0.80	54	0.70	0.15	96	0.65	0.40	138	0.70	0.55	180	0.80	0.35
13	0.70	0.55	55	0.75	0.50	97	0.70	0.45	139	0.60	0.50	181	0.90	0.10
14	0.55	0.70	56	0.65	0.50	98	0.60	0.65	140	0.65	0.50	182	0.60	0.35
15	0.60	0.75	57	0.75	0.50	99	0.65	0.50	141	0.70	0.30	183	0.80	0.25
16	0.65	0.65	58	0.65	0.50	100	0.65	0.60	142	0.75	0.35	184	0.60	0.35
17	0.60	0.70	59	0.50	0.65	101	0.45	0.65	143	0.65	0.25	185	0.60	0.40
18	0.60	0.75	60	0.60	0.50	102	0.65	0.55	144	0.80	0.25	186	0.70	0.30
19	0.70	0.45	61	0.50	0.55	103	0.70	0.60	145	0.65	0.40	187	0.60	0.60
20	0.55	0.65	62	0.60	0.35	104	0.65	0.60	146	0.75	0.50	188	0.60	0.50
21	0.55	0.70	63	0.50	0.45	105	0.70	0.55	147	0.90	0.15	189	0.65	0.55
22	0.45	0.75	64	0.75	0.25	106	0.75	0.50	148	0.90	0.20	190	0.60	0.45
23	0.65	0.55	65	0.50	0.35	107	0.70	0.50	149	0.65	0.45	191	0.60	0.50
24	0.70	0.55	66	0.70	0.35	108	0.75	0.40	150	0.90	0.10	192	0.60	0.60
25	0.60	0.60	67	0.85	0.25	109	0.75	0.45	151	0.55	0.50	193	0.55	0.60
26	0.50	0.70	68	0.65	0.35	110	0.65	0.50	152	0.75	0.40	194	0.60	0.65
27	0.50	0.60	69	0.70	0.30	111	0.75	0.35	153	0.55	0.50	195	0.70	0.45
28	0.50	0.20	70	0.45	0.50	112	0.65	0.50	154	0.65	0.40	196	0.25	0.00
29	0.30	0.60	71	0.70	0.45	113	0.85	0.20	155	0.55	0.45	197	0.80	0.35
30	0.45	0.60	72	0.55	0.55	114	0.80	0.35	156	0.60	0.45	198	0.75	0.40
31	0.30	0.50	73	0.60	0.45	115	0.80	0.30	157	0.70	0.40	199	0.80	0.35
32	0.35	0.45	74	0.55	0.45	116	0.80	0.30	158	0.70	0.50	200	0.90	0.35
33	0.40	0.35	75	0.50	0.60	117	0.75	0.30	159	0.15	0.00	201	0.80	0.30
34	0.00	0.15	76	0.65	0.45	118	0.75	0.30	160	0.20	0.00	202	0.75	0.25
35	0.00	0.10	77	0.60	0.45	119	0.65	0.40	161	0.20	0.10	203	0.55	0.35
36	0.55	0.35	78	0.60	0.45	120	0.75	0.20	162	0.05	0.10	204	0.50	0.60
37	0.65	0.30	79	0.55	0.50	121	0.75	0.50	163	0.20	0.05	205	0.50	0.65
38	0.60	0.35	80	0.65	0.45	122	0.75	0.25	164	0.20	0.05	206	0.05	0.15
39	0.60	0.45	81	0.75	0.45	123	0.80	0.30	165	0.15	0.00	207	0.30	0.50
40	0.55	0.55	82	0.75	0.25	124	0.75	0.40	166	0.10	0.10	208	0.70	0.45
41	0.50	0.60	83	0.10	0.05	125	0.50	0.40	167	0.20	0.00	209	0.30	0.75
42	0.50	0.45	84	0.80	0.20	126	0.65	0.40	168	0.35	0.15			

Appendix 6h: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L8

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.30	0.70	43	0.60	0.10	85	0.55	0.15	127	0.40	0.40	169	0.45	0.30
2	0.25	0.60	44	0.05	0.05	86	0.50	0.35	128	0.60	0.15	170	0.40	0.30
3	0 50	0.00	45	0 40	0.30	87	0.35	0.40	129	0.75	0.10	171	0.55	0.10
4	0.30	0.45	46	0.45	0 35	88	0 55	0 20	130	0 60	0.20	172	0.45	0 45
5	0.35	0.50	47	0.40	0.40	89	0.45	0 55	131	0 50	0.25	173	0.40	0.40
6	0.40	0 35	48	0 50	0.35	90	0.55	0.40	132	0 55	0 35	174	0.50	0 40
7	0 45	0.45	49	0 45	0.40	91	0.40	0 50	133	0 50	0 25	175	0 45	0 35
8	0 10	0 05	50	0.45	0 30	92	0.45	0 35	134	0 60	0 45	176	0 45	0.40
9	0.35	0.00	51	0.50	0.20	93	0.50	0.40	135	0.60	0.10	177	0.50	0.50
10	0 35	0.25	52	0.55	0 30	94	0.50	0 00	136	0 55	0.20	178	0 40	0.45
11	0 05	0.00	53	0.60	0.00	95	0.60	0 10	137	0 60	0.50	179	0.45	0.55
12	0.15	0 60	54	0.55	0.10	96	0.50	0.20	138	0 55	0 45	180	0 55	0.30
13	0.55	0 40	55	0.60	0.35	97	0.50	0 40	139	0 40	0 40	181	0.15	0.00
14	0.40	0.55	56	0.50	0.30	98	0.45	0 50	140	0 50	0 30	182	0.60	0.30
15	0.45	0 65	57	0.55	0.35	99	0.50	0.30	141	0 55	0.20	183	0.55	0.20
16	0.50	0 50	58	0.50	0 40	100	0.55	0 50	142	0 60	0.20	184	0.65	0.20
17	0 45	0 60	59	0 35	0.45	101	0.30	0 60	143	0 50	0 20	185	0.70	0.30
18	0 50	0 50	60	0 45	0 35	102	0.55	0 45	144	0 60	0 15	186	0 60	0.20
19	0.50	0 30	61	0 35	0 45	103	0 60	0 50	145	0 50	0 20	187	0.55	0.20
20	0 40	0 55	62	0 45	0.30	104	0.60	0.45	146	0 55	0 30	188	0.40	0.25
21	0.40	0.65	63	0.40	0.35	105	0.60	0.50	147	0 70	0.00	189	0.40	0.45
22	0.30	0.70	64	0.55	0.05	106	0.60	0.40	148	0 80	0 10	190	0.35	0.50
23	0.50	0.45	65	0.35	0.20	107	0.55	0 35	149	0.55	0 35	191	0.00	0.10
24	0.50	0.35	66	0.50	0.20	108	0.65	0.35	150	0.75	0.05	192	0.20	0.30
25	0.45	0.60	67	0.65	0.15	109	0.40	0.40	151	0.40	0.30	193	0.55	0.35
26	0.35	0.50	68	0.50	0.20	110	0.55	0.25	152	0.60	0.30	194	0.20	0.60
27	0.35	0.40	69	0.50	0.10	111	0.55	0.35	153	0 45	0.40	195	0.05	0.00
28	0.20	0.05	70	0.30	0.40	112	0.65	0.25	154	0 55	0.30	196	0.20	0.05
29	0.30	0.45	71	0 50	0.30	113	0.60	0.20	155	0 45	0 35	197	0 50	0.40
30	0.20	0.50	72	0.40	0.50	114	0.65	0.00	156	0 45	0.40	198	0 55	0.25
31	0.25	0.50	73	0.45	0.40	115	0.60	0.25	157	0 60	0 35	199	0.40	0.35
32	0 30	0.20	74	0.55	0.35	116	0.55	0 20	158	0 55	0.40	200	0.55	0.40
33	0 20	0.20	75	0.35	0.50	117	0.60	0.25	159	0 05	0.00	201	0.50	0.30
34	0 00	0.05	76	0.50	0.40	118	0.50	0.30	160	0.10	0 00	202	0.60	0.15
35	0.00	0.05	77	0.45	0.30	119	0.65	0.00	161	0 10	0.05	203	0.60	0.10
36	0.40	0.25	78	0 45	0.35	120	0.65	0.30	162	0 00	0 10	204	0.60	0.10
37	0.50	0.20	79	0.50	0.40	121	0.65	0.15	163	0 15	0 00	205	0.65	0.20
38	0.45	0.25	80	0.50	0.35	122	0.60	0.20	164	0.10	0.00	206	0.70	0.00
39	0.50	0.35	81	0.55	0.30	123	0.50	0 25	165	0 05	0 00	207	0.35	0.30
40	0.40	0.45	82	0.55	0.10	124	0.35	0.30	166	0 05	0.05	208	0.65	0.20
41	0.35	0.45	83	0 05	0 00	125	0.50	0.30	167	0 10	0 00	209	0.40	0.40
42	0.35	0 35	84	0.60	0 10	126	0.55	0 35	168	0 15	0 10			

Appendix 6i: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw L9

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.00	0.15	43	0.30	0.45	85	0.55	0.05	127	0.30	0.25	169	0.05	0.00
2	0.25	0.35	44	0.30	0.40	86	0.45	0.00	128	0.00	0.05	170	0.10	0.05
3	0.05	0.35	45	0.35	0.35	87	0.40	0.10	129	0.35	0.05	171	0.45	0.25
4	0.05	0.05	46	0.40	0.35	88	0.40	0.15	130	0.35	0.00	172	0.25	0.20
5	0.20	0.00	47	0.35	0.35	89	0.50	0 15	131	0.45	0.00	173	0 05	0 05
6	0.30	0.45	48	0.35	0.30	90	0.40	0 30	132	0.35	0.00	174	0.45	0 20
7	0.35	0.15	49	0.30	0.30	91	0.45	0.30	133	0.45	0.00	175	0.40	0.00
8	0.10	0.35	50	0.25	0.30	92	0.50	0.05	134	0.40	0 20	176	0.50	0.20
9	0.25	0.30	51	0.30	0.30	93	0.45	0.05	135	0.00	0.00	177	0.50	0.10
10	0.20	0.35	52	0.35	0.25	94	0.45	0 40	136	0.05	0.00	178	0.40	0.10
11	0.35	0.35	53	0.40	0.25	95	0.40	0.45	137	0.45	0.20	179	0.40	0.15
12	0.10	0.00	54	0.30	0.25	96	0.40	0.10	138	0.30	0.15	180	0 20	0 20
13	0.00	0.00	55	0.20	0.25	97	0.45	0.00	139	0 30	0.30	181	0 35	0 25
14	0 35	0.10	56	0.30	0.25	98	0.50	0.05	140	0.25	0 05	182	0.40	0.25
15	0.55	0.15	57	0.40	0.25	99	0.30	0.20	141	0.40	0.05	183	0.50	0.00
16	0.45	0.05	58	0 30	0.25	100	0.40	0.00	142	0.45	0.15	184	0.20	0.05
17	0.40	0 05	59	0.25	0.25	101	0.40	0.00	143	0.55	0 20	185	0 50	0 05
18	0.15	0 30	60	0 25	0 20	102	0.25	0 10	144	0.40	0.00	186	0.05	0.00
19	0.20	0.35	61	0 30	0.20	103	0 45	0.45	145	0.00	0.00	187	0 45	0 00
20	0.25	0.20	62	0.25	0.20	104	0 35	0.30	146	0.05	0 00	188	0.40	0.00
21	0.40	0.25	63	0.40	0 20	105	0 40	0.25	147	0.40	0 15	189	0.25	0 00
22	0.30	0 50	64	0.35	0.20	106	0.35	0 35	148	0 60	0.10	190	0 35	0.00
23	0.35	0.35	65	0.20	0.20	107	0 20	0.35	149	0.45	0 05	191	0 35	0 00
24	0.25	0.50	66	0 30	0.20	108	0.50	0.25	150	0.40	0.30	192	0 40	0 00
25	0.15	0.05	67	0.30	0.20	109	0.45	0.10	151	0.35	0.10	193	0.40	0.00
26	0.25	0.10	68	0.30	0.20	110	0.50	0.00	152	0.40	0.00	194	0.00	0.00
27	0.30	0.10	69	0.35	0.20	111	0.50	0.15	153	0.30	0.20	195	0 25	0.00
28	0.40	0 10	70	0.35	0.20	112	0.45	0.00	154	0.00	0.00	196	0 45	0.00
29	0.05	0 20	71	0.35	0.20	113	0.10	0.25	155	0.00	0 05	197	0 35	0.20
30	0.00	0 45	72	0.45	0.20	114	0.50	0.05	156	0 00	0.25	198	0 30	0 35
31	0.35	0 00	73	0 00	0 15	115	0 40	0.30	157	0 10	0.13	199	0 15	0 55
32	0 00	0 00	74	0.30	0 15	116	0 30	0.25	158	0 40	0 15	200	0 05	0.45
33	0.20	0 10	75	0.35	0.15	117	0 40	0.00	159	0.45	0 35	201	0.00	0.00
34	0.25	0.40	76	0.45	0.15	118	0.40	0.35	160	0.60	0.15	202	0.15	0.55
35	0.25	0.40	77	0.20	0.15	119	0.50	0.35	161	0.45	0.15	203	0.30	0.45
36	0.15	0 30	78	0.15	0.15	120	0.50	0.00	162	0 25	0 00	204	0 20	0 25
37	0.00	0.00	79	0.35	0.15	121	0.35	0.15	163	0.45	0.05	205	0.25	0.30
38	0.35	0.25	80	0.35	0.15	122	0.45	0.15	164	0.45	0.25	206	0.20	0.30
39	0.45	0.15	81	0.45	0.15	123	0.40	0.10	165	0.60	0.00	207	0.20	0.20
40	0.40	0.05	82	0 30	0.15	124	0.35	0.20	166	0.25	0.25	208	0.50	0.05
41	0.35	0.30	83	0 40	0.10	125	0 50	0.20	167	0.30	0 20	209	0.40	0 45
42	0.20	0.00	84	0 30	0.05	126	0.35	0 30	168	0 00	0.00			

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Appendix 7a:Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M1

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	1.15	1.40	43	1.40	1.50	85	1.50	1.15	127	1.45	1.00	169	1.50	0.90
2	1.10	1.45	44	0.95	1.35	86	1.35	0.85	128	1.40	1.15	170	1.20	1.05
3	1.30	1.30	45	0.85	1.45	87	1.40	1.00	129	1.35	1.15	171	1.40	0.95
4	1.35	0.95	46	1.00	1.45	88	1.25	1.00	130	1.50	1.20	172	1.25	1.25
5	1.40	0.95	47	1.20	1.25	89	1.60	0.90	131	1.50	1.10	173	1.15	1.25
6	1.40	0.95	48	1.05	1.30	90	1.40	1.00	132	1.50	1.10	174	1.10	1.25
7	1.35	1.00	49	1.20	1.20	91	1.45	1.05	133	1.40	1.00	175	1.20	1.25
8	1.05	0.95	50	1.25	1.20	92	1.25	0.90	134	1.35	1.15	176	1.10	1.50
9	1.10	1.20	51	1.15	1.20	93	1.50	1.10	135	1.30	1.15	177	0.95	1.40
10	1.15	1.40	52	1.00	1.30	94	1.45	1.05	136	1.10	1.10	178	1.35	1.05
11	1.00	1.40	53	1.15	1.30	95	1.60	1.05	137	1.30	1.20	179	1.20	0.90
12	1.15	1.15	54	1.25	1.10	96	1.35	0.90	138	1.25	1.15	180	1.05	1.05
13	1.20	1.05	55	1.30	1.10	97	1.10	1.15	139	1.30	1.35	181	1.00	1.10
14	1.10	1.15	56	1.05	1.20	98	1.05	1.25	140	1.65	1.30	182	1.10	1.05
15	1.50	1.15	57	1.35	0.90	99	1.20	1.20	141	1.65	1.30	183	1.20	1.05
16	1.30	1.05	58	1.40	1.00	100	1.15	1.15	142	1.40	1.30	184	1.15	1.10
17	1.50	1.00	59	1.35	1.05	101	1.40	1.15	143	1.25	1.30	185	1.25	1.05
18	1.30	0.95	60	1.55	0.90	102	1.35	1.20	144	1.35	1.10	186	1.30	1.10
19	1.30	1.00	61	1.35	1.00	103	1.45	1.10	145	1.20	1.05	187	1.40	1.10
20	1.10	1.25	62	1.35	1.00	104	1.40	1.20	146	1.15	1.25	188	1.55	0.95
21	1.10	1.40	63	1.30	0.90	105	1.40	1.05	147	1.40	1.00	189	1.45	1.05
22	1.20	1.15	64	1.25	1.10	106	1.40	1.15	148	1.30	0.80	190	1.45	1.00
23	1.30	1.25	65	1.00	1.10	107	1.20	1.20	149	1.20	1.20	191	1.40	1.10
24	1.15	1.25	66	1.15	1.35	108	1.25	1.15	150	1.25	1.15	192	1.40	1.15
25	1.40	1.00	67	1.10	1.05	109	1.40	1.20	151	1.30	1.10	193	1.30	0.95
26	1.30	0.80	68	1.15	1.20	110	1.50	1.20	152	1.20	1.05	194	1.35	1.15
27	1.20	1.20	69	0.90	1.40	111	1.35	1.20	153	1.25	1.10	195	1.40	1.20
28	1.25	1.15	70	1.10	1.10	112	1.45	1.10	154	1.20	1.25	196	1.40	1.10
29	1.30	1.15	71	1.20	0.95	113	1.30	1.10	155	1.20	1.15	197	1.40	1.05
30	1.20	1.10	72	1.10	1.10	114	1.35	1.10	156	1.00	1.20	198	1.25	1.10
31	1.25	1.05	73	1.05	0.95	115	1.30	1.15	157	1.00	1.25	199	1.20	1.20
32	1.20	1.10	74	1.00	1.20	116	1.45	1.05	158	1.50	1.00	200	1.45	0.95
33	1.20	1.25	75	1.45	1.05	117	1.35	1.45	159	1.55	0.90	201	1.25	1.05
34	1.25	1.05	76	1.25	0.95	118	1.25	1.25	160	1.35	1.00	202	1.15	1.10
35	1.10	1.15	77	1.40	1.00	119	1.35	1.20	161	1.05	1.40	203	0.90	1.25
36	1.30	1.25	78	1.00	1.20	120	1.25	1.15	162	0.95	1.30	204	1.30	1.30
37	1.15	1.25	79	1.00	1.25	121	1.40	1.20	163	1.15	1.10	205	1.15	1.25
38	1.20	1.20	80	1.50	1.00	122	1.35	1.20	164	0.90	1.25	206	1.20	1.20
39	1.05	1.30	81	1.55	0.90	123	1.40	1.00	165	1.30	1.30	207	1.05	1.30
40	1.10	1.30	82	1.35	1.00	124	1.50	1.05	166	1.25	1.05	208	1.10	1.30
41	1.30	1.25	83	1.05	1.40	125	1.50	1.10	167	1.10	1.15	209	1.30	1.25
42	1.25	1.10	84	0.95	1.30	126	1.40	1.05	168	1.30	1.25			

Appendix 7b: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M2

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	1.10	1.30	43	0.95	1.55	85	1.20	1.05	127	1.30	1.15	169	1.00	1.05
2	1.00	1.35	44	0.85	0.90	86	1.10	1.10	128	1.40	0.95	170	1.15	1.40
3	1.30	1.35	45	0.65	1.45	87	1.20	0.85	129	1.35	1.00	171	1.00	1.20
4	1.45	1.05	46	0.95	1.35	88	1.20	0.95	130	1.30	1.10	172	1.00	0.95
5	1.40	0.85	47	0.95	1.45	89	1.50	0.95	131	1.35	1.15	173	1.00	0.85
6	1.35	0.90	48	0.95	1.20	90	1.35	0.90	132	1.35	1.05	174	1.30	1.05
7	1.35	1.00	49	1.25	1.25	91	1.40	0.85	133	1.40	1.00	175	1.35	1.10
8	1.15	0.90	50	1.00	1.15	92	1.45	0.95	134	1.45	0.75	176	1.20	1.05
9	1.05	1.20	51	1.20	1.20	93	1.60	0.90	135	1.45	1.10	177	1.05	1.10
10	1.05	1.30	52	1.25	1.20	94	1.50	0.65	136	1.45	1.05	178	1.00	1.10
11	0.85	1.35	53	1.15	1.30	95	1.75	0.80	137	1.40	1.00	179	1.10	1.15
12	1.15	1.15	54	1.00	1.30	96	1.65	0.85	138	1.40	1.15	180	1.20	1.00
13	1.15	1.05	55	1.15	1.10	97	1.55	0.75	139	1.50	1.10	181	1.45	1.10
14	1.10	1.10	56	1.25	1.10	98	1.65	1.10	140	1.30	1.25	182	1.40	0.90
15	1.05	1.10	57	1.35	1.20	99	1.30	1.20	141	1.30	1.30	183	1.45	1.00
16	1.30	1.00	58	1.05	0.90	100	1.05	1.20	142	1.25	0.90	184	1.25	0.95
17	1.50	0.95	59	1.35	0.95	101	1.30	1.10	143	1.65	0.85	185	1.45	1.25
18	1.30	0.90	60	1.35	0.95	102	1.25	1.10	144	1.35	1.15	186	1.30	1.15
19	1.20	0.95	61	1.30	0.85	103	1.15	1.10	145	1.15	1.00	187	1.15	0.60
20	1.05	1.15	62	1.55	0.90	104	1.40	1.20	146	1.35	1.00	188	1.65	1.20
21	1.00	1.35	63	1.35	0.95	105	1.35	1.05	147	1.30	1.10	189	1.20	1.60
22	1.15	1.05	64	1.30	0.90	106	1.50	1.15	148	1.05	1.30	190	1.00	1.30
23	1.25	1.15	65	1.40	1.05	107	1.40	1.05	149	0.85	1.35	191	1.40	1.00
24	1.05	1.20	66	1.25	1.05	108	1.40	1.00	150	1.10	1.15	192	1.30	1.05
25	1.45	0.85	67	1.10	1.35	109	1.50	1.15	151	1.15	1.05	193	1.40	1.00
26	1.30	0.80	68	1.20	1.10	110	1.30	1.10	152	1.10	1.10	194	1.45	0.95
27	1.25	1.15	69	1.05	1.20	111	1.25	1.10	153	1.05	1.10	195	1.30	1.05
28	1.25	1.10	70	1.15	1.15	112	1.35	1.10	154	1.30	1.00	196	1.35	0.95
29	1.35	0.95	71	1.00	1.00	113	1.20	1.10	155	1.50	0.95	197	1.35	1.00
30	1.20	1.05	72	1.15	0.85	114	1.30	0.80	156	1.30	0.90	198	1.45	1.00
31	1.25	1.00	73	1.40	1.00	115	1.65	1.05	157	1.20	0.95	199	1.40	1.05
32	1.15	1.10	74	1.25	0.95	116	1.35	1.10	158	1.35	1.20	200	1.40	0.85
33	1.15	1.20	75	1.05	1.20	117	1.35	1.00	159	1.35	1.05	201	1.50	1.05
34	1.20	1.00	76	1.00	1.00	118	1.40	0.95	160	1.20	1.10	202	0.65	1.45
35	1.10	1.10	77	1.45	0.85	119	1.45	1.00	161	1.20	1.00	203	0.95	1.35
36	1.20	1.35	78	1.30	0.90	120	1.35	1.20	162	1.40	0.90	204	0.95	1.45
37	1.20	1.20	79	1.40	1.10	121	1.25	1.20	163	1.45	1.00	205	1.20	1.10
38	1.20	1.15	80	1.10	1.20	122	1.30	1.15	164	1.25	0.95	206	1.00	1.30
39	1.15	1.35	81	1.00	0.90	123	1.25	1.15	165	1.65	1.20	207	1.40	1.00
40	1.05	1.25	82	1.45	0.85	124	1.25	1.15	166	1.20	1.60	208	0.85	0.90
41	1.35	1.20	83	1.50	0.90	125	1.30	1.00	167	1.00	1.30	209	1.15	1.25
42	1.35	1.05	84	1.35	1.35	126	1.40	1.00	168	0.95	1.55			

Appendix 7c: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M3

Tooth No.	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	1.00	1.25	43	0.75	1.00	85	1.35	0.80	127	1.45	0.95	169	1.20	1.10
2	0.90	1.20	44	0.90	1.35	86	1.30	0.95	128	1.35	1.10	170	1.45	0.90
3	1.30	1.05	45	0.90	1.30	87	1.20	0.95	129	1.45	1.00	171	1.35	0.95
4	1.50	0.75	46	1.20	1.35	88	1.35	0.85	130	1.40	0.95	172	1.40	0.80
5	1.45	0.80	47	1.15	1.15	89	1.55	0.80	131	1.35	0.70	173	1.15	0.95
6	1.50	0.80	48	1.00	1.25	90	1.35	0.90	132	1.20	0.95	174	1.35	0.90
7	1.20	0.95	49	1.15	1.10	91	1.35	0.80	133	1.30	0.80	175	1.25	1.20
8	1.15	0.90	50	1.15	1.45	92	1.65	0.65	134	1.10	1.00	176	1.10	1.20
9	0.95	1.15	51	1.10	1.15	93	1.65	0.60	135	1.25	1.00	177	1.60	1.55
10	0.95	1.20	52	1.05	1.25	94	1.50	0.70	136	1.20	0.90	178	1.20	1.10
11	1.25	0.65	53	1.10	1.20	95	1.70	0.55	137	1.25	0.85	179	0.95	1.50
12	1.00	1.00	54	1.25	0.95	96	1.40	0.95	138	1.55	0.85	180	0.85	1.25
13	1.15	1.00	55	1.20	1.10	97	1.20	1.05	139	1.35	1.00	181	1.00	1.45
14	1.10	1.05	56	1.10	1.10	98	1.40	1.00	140	1.20	1.05	182	1.15	0.95
15	1.05	1.05	57	1.30	0.90	99	1.25	0.95	141	1.30	0.95	183	0.95	1.00
16	1.30	0.95	58	1.30	0.90	100	1.25	1.00	142	1.20	0.90	184	0.95	1.20
17	1.40	0.90	59	1.30	0.85	101	1.45	0.95	143	1.10	0.70	185	1.15	0.95
18	1.30	0.85	60	1.50	0.80	102	1.40	1.10	144	1.05	1.00	186	1.25	0.85
19	1.15	0.95	61	1.55	0.60	103	1.40	1.00	145	0.95	1.00	187	1.15	1.00
20	1.05	1.10	62	1.30	0.85	104	1.55	0.95	146	1.15	0.95	188	1.00	1.05
21	0.95	1.30	63	1.40	0.85	105	1.40	1.00	147	1.10	0.85	189	1.00	1.00
22	1.25	0.95	64	1.20	0.95	106	1.45	0.95	148	1.20	1.10	190	0.90	1.00
23	1.25	0.90	65	1.00	1.05	107	1.20	1.10	149	1.20	1.20	191	1.20	1.05
24	1.05	1.15	66	1.20	1.30	108	1.20	1.10	150	0.85	0.75	192	1.05	1.05
25	1.40	0.70	67	1.20	0.85	109	1.40	1.00	151	0.70	0.80	193	1.25	0.95
26	1.25	0.70	68	1.30	1.20	110	1.45	1.05	152	1.10	1.00	194	1.20	1.00
27	1.20	1.00	69	0.90	1.15	111	0.90	0.50	153	1.00	0.90	195	1.35	1.00
28	1.20	1.10	70	1.40	0.80	112	0.60	0.80	154	0.90	0.85	196	1.35	0.95
29	1.25	0.90	71	1.30	0.80	113	1.20	0.95	155	1.30	0.80	197	1.25	0.90
30	1.20	1.05	72	1.20	0.95	114	1.25	1.00	156	1.20	0.95	198	1.30	1.00
31	1.25	0.95	73	0.85	0.75	115	1.35	1.00	157	0.85	0.75	199	1.40	0.85
32	1.15	1.10	74	1.20	0.90	116	1.40	0.90	158	1.20	0.90	200	1.35	1.00
33	1.10	1.20	75	1.40	0.90	117	1.25	1.05	159	1.40	0.80	201	1.30	0.95
34	1.20	1.00	76	1.40	0.80	118	1.15	1.20	160	1.40	0.90	202	1.40	0.90
35	1.10	1.10	77	1.35	0.90	119	1.20	1.15	161	1.35	1.10	203	1.65	0.70
36	1.15	1.20	78	1.10	1.10	120	1.15	1.05	162	1.10	1.15	204	1.30	1.00
37	1.15	1.10	79	0.90	1.15	121	1.25	1.10	163	0.90	0.85	205	0.85	0.50
38	1.15	1.10	80	1.40	0.85	122	1.25	1.00	164	1.40	0.80	206	1.40	0.85
39	1.00	1.25	81	1.45	0.80	123	1.35	1.00	165	1.45	0.80	207	1.40	0.95
40	1.00	1.20	82	1.30	0.80	124	1.35	0.95	166	1.30	1.30	208	1.15	1.00
41	1.30	1.10	83	1.05	1.30	125	1.35	1.00	167	1.05	1.20	209	0.95	1.20
42	1.25	1.00	84	1.00	1.20	126	1.25	0.90	168	1.00	0.95			

Appendix 7d: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M4

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	0.95	1.10	43	0.75	1.00	85	1.20	0.75	127	1.20	0.95	169	0.90	0.90
2	0.85	1.15	44	0.85	0.75	86	1.20	0.80	128	1.25	0.85	170	0.90	1.15
3	1.15	1.10	45	0.80	1.10	87	1.25	0.80	129	1.25	0.85	171	1.10	1.05
4	1.20	0.65	46	1.00	1.30	88	1.40	0.75	130	1.15	0.60	172	1.10	0.85
5	1.15	0.75	47	0.95	1.05	89	1.30	0.70	131	1.25	0.85	173	1.05	0.75
6	1.20	0.70	48	1.05	1.15	90	1.25	0.75	132	1.15	0.80	174	0.95	0.90
7	1.10	0.80	49	1.00	1.05	91	1.45	0.65	133	1.15	0.85	175	0.90	1.00
8	1.00	0.70	50	1.00	1.00	92	1.40	0.50	134	0.95	1.00	176	0.95	0.90
9	0.80	0.85	51	0.95	1.05	93	1.35	0.50	135	1.00	0.95	177	1.10	0.90
10	0.60	0.50	52	1.00	1.10	94	1.50	0.60	136	1.10	1.05	178	1.00	0.95
11	1.30	0.20	53	1.10	1.00	95	1.20	0.45	137	1.10	1.05	179	1.10	1.00
12	0.90	0.75	54	1.15	0.75	96	1.05	0.75	138	1.35	0.75	180	1.15	0.90
13	1.00	0.80	55	0.75	0.65	97	1.20	0.95	139	1.15	0.70	181	1.25	0.95
14	0.95	0.90	56	1.20	0.75	98	1.25	0.85	140	0.90	1.00	182	1.20	0.55
15	0.90	0.90	57	1.05	0.65	99	1.15	0.70	141	1.15	0.90	183	1.05	0.65
16	1.05	0.80	58	1.10	0.80	100	1.30	0.85	142	1.05	0.80	184	1.25	0.80
17	1.15	0.70	59	1.25	0.75	101	1.20	0.80	143	1.25	0.75	185	1.15	0.60
18	1.05	0.70	60	1.25	0.65	102	1.25	0.95	144	1.25	0.65	186	1.10	0.70
19	0.90	0.80	61	1.05	0.55	103	1.25	0.90	145	1.05	0.55	187	1.10	0.80
20	0.90	1.10	62	1.10	0.75	104	1.30	0.80	146	1.10	0.75	188	0.80	0.95
21	0.80	1.20	63	0.90	0.70	105	1.30	0.90	147	0.90	0.70	189	1.20	1.05
22	1.10	0.85	64	0.75	0.95	106	1.15	0.90	148	0.75	0.95	190	1.00	0.40
23	1.10	0.85	65	1.15	0.90	107	1.10	1.00	149	1.15	0.90	191	0.75	1.00
24	1.00	1.10	66	1.00	0.90	108	1.30	0.95	150	1.00	0.90	192	0.90	1.25
25	1.30	0.60	67	0.70	0.60	109	1.30	0.90	151	0.70	0.60	193	1.10	0.50
26	1.00	0.60	68	0.30	0.65	110	1.65	0.85	152	0.30	0.65	194	0.85	1.05
27	1.00	1.00	69	0.65	1.25	111	1.40	0.45	153	0.65	1.25	195	0.90	0.90
28	1.00	0.90	70	1.00	0.60	112	1.10	0.65	154	1.00	0.60	196	0.90	1.15
29	1.05	0.70	71	1.00	0.60	113	1.10	0.90	155	1.00	0.60	197	1.20	0.85
30	1.00	0.85	72	0.75	0.90	114	1.20	0.80	156	0.75	0.90	198	1.05	0.90
31	1.00	0.75	73	0.80	0.85	115	1.20	0.85	157	0.80	0.85	199	1.15	0.80
32	1.00	0.90	74	1.20	1.00	116	1.10	0.75	158	1.20	1.00	200	1.10	0.80
33	1.05	1.00	75	1.10	0.75	117	1.00	0.85	159	1.10	0.75	201	1.20	0.85
34	0.95	0.80	76	1.20	0.75	118	1.10	1.05	160	1.20	0.75	202	1.20	0.65
35	1.00	0.95	77	1.00	0.70	119	0.95	1.00	161	1.00	0.70	203	1.25	0.85
36	1.00	1.05	78	0.90	1.00	120	1.00	1.00	162	0.90	1.00	204	1.35	0.80
37	1.00	0.95	79	1.25	1.10	121	1.05	1.00	163	1.25	1.10	205	1.15	0.85
38	0.90	0.95	80	1.35	0.75	122	1.10	1.00	164	1.35	0.75	206	1.60	0.40
39	0.90	1.10	81	1.10	0.65	123	1.10	1.00	165	1.10	0.65	207	1.20	0.75
40	1.05	1.00	82	0.90	0.75	124	1.15	0.90	166	0.90	0.75	208	1.25	0.80
41	1.05	1.00	83	0.90	0.20	125	1.05	0.85	167	0.90	0.20	209	1.25	0.80
42	1.10	0.80	84	1.10	1.05	126	1.15	0.85	168	1.10	1.05			

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Appendix 7e: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M5

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	0.95	1.00	43	0.80	0.00	85	1.15	0.70	127	1.15	0.75	169	0.90	0.85
2	0.65	1.10	44	0.80	0.70	86	1.25	0.80	128	1.20	0.85	170	1.05	1.10
3	0.95	1.00	45	0.85	1.05	87	1.15	0.80	129	1.10	0.75	171	0.95	0.85
4	1.05	0.60	46	0.80	1.20	88	1.15	0.85	130	1.20	0.80	172	1.00	0.75
5	1.10	0.65	47	1.00	1.00	89	1.30	0.70	131	1.05	0.55	173	1.00	0.75
6	1.15	0.60	48	0.95	1.10	90	1.35	0.75	132	1.15	0.80	174	1.05	0.85
7	1.05	0.75	49	1.05	1.00	91	1.25	0.70	133	0.95	0.80	175	1.00	0.65
8	1.05	0.60	50	1.05	0.90	92	1.35	0.50	134	1.10	0.75	176	1.10	0.80
9	0.75	0.95	51	1.00	1.00	93	1.10	0.45	135	1.05	0.85	177	1.20	0.80
10	0.85	0.95	52	0.90	1.10	94	1.00	0.55	136	1.05	0.80	178	1.10	0.75
11	0.85	0.55	53	0.90	1.00	95	1.15	0.35	137	1.20	0.90	179	1.55	0.50
12	0.75	0.80	54	0.95	0.75	96	1.15	0.70	138	0.95	1.00	180	1.15	0.75
13	0.85	0.80	55	1.10	0.40	97	1.00	0.90	139	0.85	0.65	181	1.20	0.40
14	0.85	0.85	56	0.75	0.60	98	1.15	0.85	140	1.10	0.65	182	1.20	0.70
15	0.85	0.85	57	1.15	0.65	99	1.20	0.65	141	1.00	0.90	183	1.15	0.70
16	0.85	0.70	58	1.00	0.75	100	1.20	0.75	142	1.00	0.70	184	0.90	0.85
17	1.00	0.65	59	1.05	0.70	101	1.20	0.70	143	1.10	0.65	185	1.05	1.10
18	1.05	0.60	60	1.20	0.60	102	1.25	0.90	144	1.20	0.60	186	1.05	1.00
19	1.00	0.70	61	1.00	0.50	103	1.25	0.85	145	1.00	0.50	187	1.00	0.80
20	0.90	0.90	62	1.10	0.65	104	1.15	0.70	146	1.10	0.65	188	0.90	0.70
21	0.85	1.10	63	0.95	0.60	105	1.10	0.80	147	0.95	0.60	189	0.95	0.85
22	0.75	0.80	64	0.75	0.80	106	1.20	0.75	148	0.75	0.80	190	1.05	0.95
23	0.90	0.80	65	1.00	0.90	107	1.10	0.90	149	1.00	0.90	191	0.90	0.90
24	1.00	0.95	66	0.60	1.05	108	1.60	0.85	150	0.60	1.05	192	0.90	0.85
25	0.90	0.55	67	0.55	0.90	109	1.20	0.80	151	0.55	0.90	193	1.10	0.90
26	1.15	0.55	68	0.15	0.60	110	1.05	0.70	152	0.15	0.60	194	1.20	0.95
27	1.00	0.95	69	0.70	1.35	111	1.05	0.35	153	0.70	1.35	195	1.05	0.85
28	0.95	0.80	70	1.00	0.60	112	1.00	0.55	154	1.00	0.60	196	1.10	0.90
29	0.95	0.65	71	1.00	0.60	113	1.10	0.80	155	1.00	0.60	197	1.05	0.35
30	0.95	0.85	72	0.85	0.85	114	1.15	0.80	156	0.85	0.85	198	1.20	0.60
31	0.80	0.60	73	0.95	0.80	115	1.00	0.80	157	0.95	0.80	199	1.05	0.75
32	1.00	0.80	74	1.10	0.85	116	0.95	0.70	158	1.10	0.85	200	1.15	0.65
33	0.95	1.00	75	1.10	0.80	117	1.00	0.85	159	1.10	0.80	201	1.00	0.80
34	1.00	0.75	76	0.90	0.90	118	0.95	0.95	160	0.90	0.90	202	1.00	0.80
35	0.90	0.80	77	0.90	0.80	119	0.95	0.85	161	0.90	0.80	203	1.05	0.90
36	1.00	1.00	78	1.10	1.10	120	1.00	0.90	162	1.10	1.10	204	1.00	1.00
37	0.95	0.90	79	1.20	1.15	121	1.10	0.90	163	1.20	1.15	205	1.20	0.50
38	0.90	0.85	80	1.05	0.75	122	1.05	0.90	164	1.05	0.75	206	0.95	0.95
39	0.85	1.10	81	0.75	0.65	123	1.05	0.80	165	0.75	0.65	207	0.90	0.90
40	1.00	1.00	82	0.90	0.70	124	1.00	0.75	166	0.90	0.70	208	0.80	0.55
41	1.05	0.90	83	1.00	1.15	125	1.05	0.80	167	1.00	1.15	209	0.90	1.15
42	0.95	0.90	84	0.85	1.00	126	1.10	0.80	168	0.85	1.00			

Appendix 7f: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M6

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	0.90	0.90	43	0.70	0.00	85	0.95	0.65	127	1.05	0.60	169	0.65	0.85
2	0.65	0.95	44	0.85	0.70	86	1.00	0.70	128	1.00	0.80	170	0.95	1.20
3	0.85	0.90	45	0.80	1.00	87	1.10	0.70	129	1.10	0.70	171	1.10	0.60
4	0.95	0.60	46	0.95	1.10	88	1.20	0.65	130	1.05	0.70	172	1.05	0.65
5	1.00	0.60	47	0.90	0.95	89	1.15	0.60	131	1.05	0.50	173	0.95	0.60
6	1.00	0.55	48	1.00	1.05	90	1.15	0.60	132	0.95	0.75	174	0.85	0.75
7	0.95	0.70	49	0.95	0.95	91	1.25	0.50	133	1.00	0.70	175	0.80	0.85
8	0.90	0.50	50	0.95	0.85	92	1.25	0.40	134	1.00	0.65	176	0.80	0.85
9	0.70	0.90	51	0.90	0.90	93	1.15	0.35	135	1.05	0.75	177	0.90	0.80
10	0.70	0.90	52	0.95	1.00	94	1.25	0.50	136	1.00	0.75	178	0.80	0.80
11	0.70	0.45	53	1.00	0.90	95	1.05	0.30	137	0.95	0.80	179	0.90	0.85
12	0.70	0.70	54	1.20	0.65	96	0.90	0.60	138	0.80	0.90	180	1.00	0.80
13	0.80	0.75	55	1.00	0.40	97	1.05	0.75	139	1.05	0.65	181	1.05	0.80
14	0.80	0.65	56	1.10	0.40	98	1.10	0.70	140	0.95	0.60	182	1.15	0.40
15	0.75	0.70	57	0.95	0.50	99	1.00	0.60	141	0.90	0.90	183	1.00	0.60
16	0.90	0.60	58	1.00	0.65	100	1.10	0.70	142	0.95	0.70	184	1.10	0.75
17	1.00	0.55	59	1.10	0.60	101	0.15	0.60	143	1.10	0.60	185	1.00	0.50
18	0.90	0.55	60	1.15	0.55	102	1.25	0.75	144	1.15	0.60	186	0.80	0.65
19	0.80	0.60	61	1.00	0.45	103	1.10	0.60	145	1.00	0.55	187	0.90	0.75
20	0.75	0.80	62	1.10	0.65	104	1.10	0.55	146	1.10	0.45	188	0.95	0.90
21	0.70	1.00	63	0.85	0.60	105	1.00	0.75	147	0.85	0.65	189	1.05	0.90
22	0.85	0.75	64	0.75	0.75	106	0.95	0.80	148	0.75	0.60	190	1.00	0.45
23	0.95	0.70	65	1.00	0.85	107	1.00	0.90	149	1.00	0.75	191	1.00	0.90
24	0.80	0.80	66	0.65	0.95	108	1.10	0.85	150	0.65	0.85	192	0.75	0.85
25	1.10	0.50	67	0.80	0.80	109	1.45	0.80	151	0.80	0.95	193	0.95	0.45
26	0.85	0.50	68	0.30	0.55	110	1.25	0.70	152	0.30	0.80	194	0.65	0.95
27	0.85	0.85	69	0.80	1.10	111	1.00	0.35	153	0.80	0.55	195	0.90	0.75
28	0.90	0.75	70	0.95	1.15	112	1.00	0.50	154	0.95	1.10	196	0.95	0.65
29	1.00	0.60	71	1.00	0.50	113	1.00	0.75	155	1.00	1.15	197	1.00	0.70
30	0.90	0.70	72	0.90	0.70	114	1.05	0.75	156	0.90	0.50	198	1.05	0.80
31	1.00	0.40	73	1.00	0.60	115	0.95	0.50	157	1.00	0.70	199	0.95	0.55
32	0.90	0.80	74	1.15	0.75	116	0.90	0.60	158	1.15	0.60	200	1.15	0.70
33	0.90	0.90	75	1.00	0.60	117	0.95	0.70	159	1.00	0.75	201	1.00	0.75
34	0.95	0.70	76	1.10	0.70	118	0.85	0.85	160	1.10	0.60	202	1.40	0.65
35	0.85	0.80	77	0.95	0.45	119	0.95	0.75	161	0.95	0.70	203	1.15	0.40
36	1.00	0.85	78	0.85	0.90	120	0.90	0.80	162	0.85	0.45	204	1.10	0.70
37	0.90	0.80	79	1.15	1.00	121	1.00	0.80	163	1.15	0.90	205	1.10	0.30
38	0.90	0.80	80	1.20	0.70	122	1.00	0.80	164	1.20	1.00	206	1.05	0.60
39	0.50	1.15	81	1.10	0.60	123	1.00	0.75	165	1.10	0.70	207	1.10	0.60
40	0.75	0.65	82	0.85	0.60	124	0.95	0.75	166	0.85	0.60	208	0.65	0.90
41	0.95	0.85	83	0.90	1.10	125	1.00	0.70	167	0.90	0.60	209	0.70	0.85
42	0.95	0.65	84	0.85	0.90	126	1.10	0.70	168	0.85	1.10			

ppendix 7g: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M7

ooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In
1	0.55	0.65	43	0.55	0.00	85	0.80	0.45	127	0.80	0.25	169	0.80	1.05
2	0.45	0.65	44	0.50	0.30	86	0.80	0.40	128	0.80	0.25	170	0.90	0.10
3	0.65	0.35	45	0.65	0.45	87	1.00	0.35	129	0.75	0.35	171	0.60	0.25
4	0.70	0.30	46	0.55	0.35	88	0.95	0.35	130	0.80	0.00	172	0.75	0.30
5	0.75	0.00	47	0.75	0.55	89	0.90	0.35	131	0.80	0.35	173	0.75	0.40
6	0.40	0.20	48	0.75	0.45	90	1.05	0.35	132	0.80	0.35	174	0.75	0.15
7	0.70	0.10	49	0.70	0.45	91	1.10	0.20	133	0.75	0.15	175	0.70	0.35
8	0.65	0.35	50	0.60	0.55	92	1.00	0.15	134	0.75	0.10	176	0.70	0.35
9	0.40	0.50	51	0.55	0.75	93	1.05	0.20	135	0.70	0.30	177	0.85	0.65
10	0.50	0.30	52	0.40	0.65	94	0.85	0.10	136	0.85	0.30	178	0.75	0.15
11	0.65	0.50	53	0.70	0.50	95	0.90	0.35	137	0.85	0.35	179	1.00	0.35
12	0.50	0.50	54	0.90	0.10	96	0.95	0.35	138	0.75	0.10	180	0.75	0.10
13	0.60	0.35	55	0.85	0.00	97	0.85	0.40	139	0.65	0.25	181	0.85	0.25
14	0.60	0.40	56	0.75	0.25	98	0.80	0.40	140	0.80	0.40	182	0.80	0.30
15	0.60	0.35	57	0.80	0.35	99	0.90	0.40	141	0.75	0.30	183	0.80	0.10
16	0.75	0.30	58	0.85	0.35	100	0.90	0.35	142	0.80	0.20	184	0.80	1.05
17	0.80	0.20	59	0.85	0.40	101	0.85	0.40	143	0.85	0.40	185	0.90	0.10
18	0.75	0.25	60	0.50	0.30	102	0.80	0.40	144	0.50	0.30	186	0.80	0.35
19	0.60	0.50	61	0.70	0.55	103	1.00	0.25	145	0.70	0.55	187	0.75	0.35
20	0.65	0.65	62	0.70	0.30	104	1.00	0.40	146	0.70	0.30	188	0.85	0.45
21	0.60	0.50	63	0.55	0.45	105	0.80	0.40	147	0.55	0.45	189	0.70	0.60
22	0.70	0.50	64	0.65	0.55	106	0.75	0.60	148	0.65	0.55	190	0.70	0.50
23	0.70	0.50	65	0.55	0.60	107	0.90	0.50	149	0.55	0.60	191	0.80	0.50
24	0.65	0.25	66	0.80	0.65	108	0.90	0.50	150	0.80	0.65	192	0.70	0.50
25	0.80	0.25	67	0.30	0.35	109	1.15	0.40	151	0.30	0.35	193	0.75	0.55
26	0.75	0.50	68	0.70	0.85	110	1.00	0.15	152	0.70	0.85	194	0.80	0.55
27	0.75	0.00	69	0.80	0.25	111	0.75	0.25	153	0.80	0.25	195	0.90	0.50
28	0.75	0.30	70	0.75	0.25	112	0.80	0.45	154	0.75	0.25	196	0.80	0.40
29	0.75	0.35	71	0.20	0.40	113	0.75	0.50	155	0.20	0.40	197	0.90	0.30
30	0.65	0.10	72	0.80	0.50	114	0.80	0.30	156	0.80	0.50	198	1.00	0.40
31	0.85	0.45	73	0.95	0.30	115	0.70	0.40	157	0.95	0.30	199	0.90	0.20
32	0.65	0.40	74	0.65	0.25	116	0.70	0.35	158	0.65	0.25	200	0.90	0.20
33	0.65	0.20	75	0.80	0.50	117	0.85	0.55	159	0.80	0.50	201	0.80	0.30
34	0.75	0.40	76	0.75	0.45	118	0.65	0.45	160	0.75	0.45	202	0.70	0.45
35	0.70	0.50	77	0.65	0.65	119	0.60	0.50	161	0.65	0.65	203	0.75	0.45
36	0.80	0.45	78	0.95	0.75	120	0.55	0.50	162	0.95	0.75	204	0.00	0.50
37	0.80	0.50	79	1.00	0.40	121	0.75	0.50	163	1.00	0.40	205	0.45	0.15
38	0.70	0.80	80	0.90	0.35	122	0.75	0.45	164	0.90	0.35	206	0.20	0.40
39	0.45	0.25	81	0.75	0.40	123	0.70	0.40	165	0.75	0.40	207	0.00	0.00
40	0.60	0.45	82	0.70	0.75	124	0.70	0.40	166	0.70	0.75	208	0.15	0.40
41	0.75	0.50	83	0.70	0.65	125	0.75	0.40	167	0.70	0.65	209	0.20	0.05
42	0.80	0.30	84	0.30	0.55	126	0.75	0.40	168	0.30	0.55			

Appendix 7h: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M8

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No.	Out	In
1	0.55	0.50	43	0.40	0.00	85	0.80	0.35	127	0.75	0.20	169	0.65	0.55
2	0.45	0.10	44	0.45	0.00	86	0.80	0.30	128	0.75	0.00	170	0.00	0.45
3	0.50	0.55	45	0.50	0.25	87	0.75	0.25	129	0.80	0.30	171	0.75	1.00
4	0.55	0.40	46	0.65	0.30	88	0.85	0.25	130	0.70	0.25	172	0.85	0.00
5	0.65	0.30	47	0.60	0.25	89	0.95	0.30	131	0.70	0.20	173	0.65	0.15
6	1.25	0.00	48	0.80	0.40	90	0 90	0.25	132	0.75	0.00	174	0.70	0.15
7	0.65	0.25	49	0.70	0.30	91	0.85	0 25	133	0.75	0.30	175	0.75	0.25
8	0.70	0.10	50	0.65	0.35	92	0.95	0.15	134	0.75	0.20	176	0.75	0.05
9	0.35	0.35	51	0.00	0.55	93	0.95	0.10	135	0.65	0.20	177	0.70	0.25
10	0.20	0.40	52	0.20	0.20	94	0.85	0.15	136	0.75	0.30	178	0.70	0.25
11	0.00	0.45	53	0.00	0.35	95	0.90	0.05	137	0.70	0.20	179	0.80	0.15
12	0.50	0.30	54	0.00	0.70	96	0.80	0.25	138	0.70	0.35	180	0.75	0.10
13	0.60	0.25	55	0.10	0.90	97	0.80	0.25	139	0.75	0.50	181	0.95	0.25
14	0.55	0.00	56	0.80	0.65	98	0.85	0.30	140	0.65	0.25	182	0.75	0.00
15	0.50	0.20	57	0.70	0.15	99	0.80	0 20	141	0.65	0.15	183	0.80	0.00
16	0.65	0.15	58	0.70	0.25	100	0.75	0.30	142	0.80	0.20	184	0.75	0.10
17	0.75	0.00	59	0.75	0.25	101	0.85	0.15	143	0.75	0.15	185	0.85	0.00
18	0.25	0.00	60	0.85	0.20	102	0.75	0.30	144	0.70	0.25	186	0.75	0.35
19	0.55	0.05	61	0.75	0.15	103	0.85	0.20	145	0.75	0.25	187	0.90	0.10
20	0.50	0.30	62	0.85	0.30	104	0.80	0.15	146	0.85	0.20	188	0.70	0.30
21	0.60	0.45	63	0.65	0.25	105	0.90	0.35	147	0.75	0.15	189	0.80	0.45
22	0.65	0.30	64	0.50	0.35	106	0.85	0.40	148	0.85	0.30	190	0.70	0.35
23	0.60	0.25	65	0.65	0.35	107	0.80	0.50	149	0.65	0.25	191	0.85	0.35
24	0.80	0.30	66	0.40	0.40	108	0.70	0.35	150	0.50	0.35	192	0.60	0.35
25	0.70	0.10	67	0.00	0.55	109	0 71	0.35	151	0.65	0.35	193	0.80	0.35
26	0.55	0.15	68	0.40	0.85	110	0.80	0.30	152	0.40	0.40	194	0.80	0.05
27	0.70	0.45	69	0.45	0.50	111	1.10	0.05	153	0.00	0.55	195	0.80	0.15
28	0.70	0.00	70	0.65	0.30	112	0.85	0.20	154	0.40	0.85	196	0.80	0.25
29	0.60	0.20	71	0.75	0.15	113	0.75	0.35	155	0.45	0.50	197	0.70	0.05
30	0.90	0.15	72	0.40	0.35	114	0.75	0.30	156	0.65	0.30	198	0.70	0.25
31	0.60	0.00	73	0.80	0.55	115	0.75	0.25	157	0.75	0.15	199	0.70	0.25
32	0.30	0.30	74	0.75	0.05	116	0.70	0.15	158	0.40	0.35	200	0.65	0.00
33	0.00	0.70	75	0.75	0.25	117	0.60	0.20	159	0.80	0.55	201	0.00	0.30
34	0.60	0.90	76	0.80	0.25	118	0.65	0.35	160	0.75	0.05	202	0.45	0.10
35	0.70	0.25	77	0.65	0.20	119	0.60	0.35	161	0.75	0.25	203	0.20	0.35
36	0.60	0.00	78	0.75	0.50	120	0.60	0.40	162	0.80	0.25	204	0.00	0.00
37	0.65	0.35	79	0.95	0.60	121	0.70	0.45	163	0.65	0.20	205	0.50	0.45
38	0.35	0.20	80	1.00	0.35	122	0.75	0.35	164	0.75	0.50	206	0.75	0.75
39	0.45	0.55	81	0.85	0.25	123	0.80	0.30	165	0.95	0.60	207	0.80	0.25
40	0.70	0.00	82	0.50	0.30	124	0.75	0.30	166	1.00	0.35	208	0.00	0.45
41	0.75	0.30	83	0.75	0.75	125	0.75	0.25	167	0.85	0.25	209	0.85	0.10
42	0.80	0.40	84	0.65	0.55	126	0.75	0.25	168	0.50	0.30			

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ppendix 7i: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw M9

oth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No.	Out	In
1	0.45	0.30	43	0.40	0.00	85	0.60	0.05	127	0.50	0.10	169	0.65	0.00
2	0.35	0.05	44	0.45	0.15	86	0.70	0.05	128	0.55	0.15	170	0.60	0.05
3	0.40	0.40	45	0.40	0.15	87	0.50	0.10	129	0.55	0.10	171	0.50	0.15
4	0.40	0.30	46	0.60	0.10	88	0.55	0.05	130	0.55	0.00	172	0.50	0.00
5	0.50	0.20	47	0.50	0.20	89	0.60	0.10	131	0.50	0.15	173	0.40	0.10
6	1.10	0.00	48	0.45	0.10	90	0.50	0.00	132	0.55	0.10	174	0.55	0.05
7	0.50	0.15	49	0.00	0.20	91	0.55	0.00	133	0.55	0.10	175	0.00	0.00
8	0.55	0.05	50	0.15	0.30	92	0.70	0.00	134	0.50	0.10	176	0.35	0.15
9	0.25	0.20	51	0.00	0.10	93	0.65	0.00	135	0.65	0.10	177	0.10	0.05
10	0.10	0.25	52	0.00	0.20	94	0.75	0.05	136	0.35	0.20	178	0.00	0.15
11	0.00	0.25	53	0.00	0.45	95	0.50	0.10	137	0.45	0.30	179	0.30	0.00
12	0.40	0.20	54	0.05	0.65	96	0.50	0.10	138	0.60	0.15	180	0.35	0.25
13	0.35	0.10	55	0.65	0.40	97	0.55	0.05	139	0.60	0.00	181	0.35	0.00
14	0.40	0.00	56	0.65	0.05	98	0.70	0.10	140	0.50	0.05	182	0.65	0.00
15	0.35	0.05	57	0.65	0.15	99	0.65	0.05	141	0.55	0.00	183	0.55	0.00
16	0.50	0.10	58	0.75	0.10	100	0.75	0.10	142	0.65	0.05	184	0.70	0.15
17	0.65	0.00	59	0.65	0.05	101	0.60	0.20	143	0.55	0.10	185	0.60	0.00
18	0.10	0.00	60	0.75	0.00	102	0.65	0.10	144	0.65	0.10	186	0.55	0.10
19	0.40	0.00	61	0.45	0.10	103	0.65	0.10	145	0.45	0.00	187	0.60	0.25
20	0.30	0.10	62	0.30	0.15	104	0.65	0.20	146	0.30	0.10	188	0.65	0.15
21	0.40	0.30	63	0.45	0.20	105	0.55	0.30	147	0.45	0.05	189	0.40	0.20
22	0.50	0.20	64	0.20	0.15	106	0.60	0.15	148	0.20	0.15	190	0.60	0.15
23	0.40	0.20	65	0.00	0.20	107	0.55	0.15	149	0.00	0.20	191	0.55	0.15
24	0.60	0.15	66	0.30	0.40	108	0.90	0.10	150	0.20	0.20	192	0.60	0.00
25	0.50	0.05	67	0.25	0.60	109	0.40	0.00	151	0.25	0.35	193	0.65	0.15
26	0.40	0.05	68	0.45	0.30	110	0.55	0.00	152	0.45	0.60	194	0.60	0.10
27	0.60	0.30	69	0.55	0.10	111	0.55	0.10	153	0.55	0.30	195	0.55	0.00
28	0.55	0.00	70	0.20	0.00	112	0.55	0.20	154	0.20	0.20	196	0.60	0.00
29	0.45	0.10	71	0.65	0.15	113	0.45	0.10	155	0.60	0.00	197	0.55	0.10
30	0.70	0.05	72	0.55	0.30	114	0.35	0.05	156	0.55	0.20	198	0.50	0.00
31	0.40	0.00	73	0.70	0.00	115	0.40	0.05	157	0.55	0.35	199	0.55	0.15
32	0.20	0.10	74	0.60	0.10	116	0.35	0.00	158	0.60	0.00	200	0.50	0.05
33	0.00	0.30	75	0.45	0.05	117	0.35	0.15	159	0.45	0.10	201	0.70	0.00
34	0.40	0.70	76	0.60	0.00	118	0.45	0.15	160	0.55	0.05	202	0.55	0.00
35	0.50	0.10	77	0.75	0.30	119	0.50	0.20	161	0.75	0.10	203	0.55	0.05
36	0.45	0.00	78	0.80	0.40	120	0.65	0.25	162	0.80	0.30	204	0.55	0.00
37	0.60	0.25	79	0.65	0.15	121	0.50	0.15	163	0.65	0.35	205	0.55	0.00
38	0.20	0.10	80	0.30	0.10	122	0.50	0.10	164	0.30	0.15	206	0.60	0.05
39	0.30	0.35	81	0.45	0.10	123	0.50	0.10	165	0.55	0.20	207	0.50	0.00
40	0.50	0.00	82	0.45	0.60	124	0.65	0.15	166	0.45	0.10	208	0.65	0.25
41	0.60	0.20	83	0.00	0.35	125	0.40	0.15	167	0.00	0.55	209	0.50	0.80
42	0.75	0.20	84	0.55	0.25	126	0.55	0.10	168	0.55	0.35			

Appendix 8a : Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N1

Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out
1	1.10	1.70	43	1.30	1.45	85	1.25	1.40	127	1.20	1.50	169	1.35	1.10
2	1.30	1.40	44	1.35	1.50	86	1.50	1.20	128	1.25	1.55	170	1.30	1.30
3	1.10	1.35	45	1.30	1.40	87	1.20	1.40	129	1.20	1.40	171	1.30	1.30
4	1.15	1.40	46	1.35	1.45	88	1.15	1.20	130	1.05	1.30	172	1.35	1.40
5	1.20	1.30	47	1.35	1.50	89	1.15	1.50	131	1.10	1.45	173	1.25	1.55
6	0.95	1.20	48	1.50	1.40	90	1.25	1.50	132	1.25	1.30	174	1.20	1.30
7	1.20	1.25	49	1.40	1.30	91	1.20	1.55	133	1.20	1.35	175	1.30	1.50
8	1.20	1.55	50	1.50	1.35	92	1.25	1.40	134	1.20	1.65	176	1.20	1.45
9	1.15	1.65	51	1.50	1.40	93	1.30	1.45	135	1.40	1.45	177	1.30	1.50
10	1.10	1.55	52	1.30	1.25	94	1.20	1.40	136	1.40	1.50	178	1.50	1.50
11	1.35	1.40	53	1.40	1.40	95	1.15	1.45	137	1.40	1.50	179	1.45	1.40
12	1.30	1.45	54	1.30	1.55	96	1.35	1.60	138	1.20	1.45	180	1.40	1.60
13	1.25	1.50	55	1.35	1.35	97	1.35	1.50	139	1.30	1.50	181	1.40	1.60
14	1.40	1.35	56	1.30	1.45	98	1.20	1.40	140	0.95	1.55	182	1.30	1.25
15	1.50	1.35	57	1.20	1.60	99	1.25	1.55	141	1.35	1.40	183	1.25	1.45
16	1.50	1.25	58	1.20	1.60	100	1.10	1.40	142	1.30	1.30	184	1.30	1.40
17	1.35	1.45	59	1.35	1.60	101	1.10	1.60	143	1.55	1.60	185	1.40	1.40
18	1.30	1.50	60	1.25	1.50	102	1.40	1.60	144	1.50	1.35	186	1.30	1.50
19	1.45	1.30	61	1.50	1.60	103	1.50	1.45	145	1.50	1.40	187	1.40	1.40
20	1.35	1.40	62	1.20	1.45	104	1.60	1.40	146	1.45	1.65	188	0.95	1.50
21	1.35	1.50	63	1.25	1.60	105	1.30	1.25	147	1.60	1.35	189	1.35	1.50
22	1.55	1.45	64	1.25	1.60	106	1.25	1.40	148	1.45	1.50	190	1.40	1.45
23	1.20	1.50	65	1.30	1.50	107	1.25	1.55	149	1.65	1.45	191	1.40	1.40
24	1.15	1.60	66	1.25	1.60	108	1.40	1.65	150	1.40	1.31	192	1.35	1.50
25	1.30	1.50	67	1.25	1.50	109	1.40	1.30	151	1.40	1.20	193	1.50	1.45
26	1.30	1.40	68	1.35	1.40	110	1.35	1.45	152	1.20	1.60	194	1.30	1.30
27	1.10	1.25	69	1.20	1.45	111	1.20	1.45	153	1.45	1.45	195	1.50	1.45
28	1.30	1.45	70	1.45	1.45	112	1.30	1.50	154	1.20	1.60	196	1.30	1.25
29	1.10	1.40	71	1.45	1.40	113	1.40	1.65	155	1.35	1.50	197	1.30	1.35
30	1.10	1.40	72	1.50	1.25	114	1.35	1.40	156	1.60	1.60	198	1.45	1.25
31	1.05	1.40	73	1.20	1.40	115	1.50	1.25	157	1.35	1.45	199	1.45	1.30
32	1.10	1.50	74	1.30	1.35	116	1.35	1.40	158	1.25	1.10	200	1.30	1.45
33	1.50	1.40	75	1.20	1.45	117	1.40	1.30	159	1.40	1.50	201	1.25	1.35
34	1.30	1.10	76	0.95	1.25	118	1.35	1.40	160	1.40	1.50	202	1.55	1.45
35	1.25	1.40	77	1.30	1.50	119	1.25	1.50	161	1.45	1.50	203	1.65	1.20
36	1.25	1.35	78	1.15	1.25	120	1.50	1.40	162	1.45	1.40	204	1.30	1.40
37	1.40	1.35	79	1.25	1.60	121	1.40	1.35	163	1.30	1.35	205	1.35	1.55
38	1.20	1.25	80	1.30	1.50	122	1.30	1.50	164	1.35	1.35	206	1.50	1.40
39	1.25	1.30	81	1.25	1.40	123	1.35	1.40	165	1.40	1.35	207	1.35	1.40
40	1.35	1.50	82	1.35	1.50	124	1.45	1.25	166	1.40	1.40	208	1.40	1.20
41	1.30	1.55	33	1.35	1.40	125	1.30	1.40	167	1.40	1.30	209	1.30	1.60
42	1.30	1.50	84	1.30	1.60	126	1.45	1.40	168	1.10	1.15			

ppendix 8b :Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N2

Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out
1	0.85	1.85	43	1.40	1.35	85	1.15	1.40	127	1.15	1.40	169	1.25	1.35
2	1.15	1.40	44	1.20	1.50	86	1.30	1.50	128	1.15	1.45	170	1.45	1.25
3	1.00	1.45	45	1.15	1.50	87	1.15	1.35	129	1.15	1.35	171	1.50	1.30
4	1.05	1.45	46	1.00	1.40	88	1.10	1.50	130	1.15	1.40	172	1.30	1.35
5	1.15	1.35	47	1.35	1.40	89	1.05	1.50	131	0.95	1.50	173	1.35	1.25
6	0.90	1.25	48	1.25	1.45	90	1.20	1.45	132	1.05	1.40	174	1.45	1.20
7	1.20	1.20	49	1.40	1.30	91	1.15	1.40	133	1.05	1.35	175	1.40	1.30
8	1.25	1.50	50	1.35	1.35	92	1.10	1.40	134	1.15	1.85	176	1.30	1.15
9	1.05	1.55	51	1.35	1.35	93	1.25	1.40	135	1.20	1.45	177	1.10	1.45
10	0.95	1.45	52	1.35	1.30	94	1.20	1.45	136	1.45	1.40	178	1.15	1.50
11	1.25	1.50	53	1.30	1.35	95	1.25	1.60	137	1.50	1.35	179	1.20	1.45
12	0.70	1.85	54	1.35	1.50	96	1.35	1.10	138	1.45	1.35	180	1.25	1.30
13	1.10	1.50	55	1.30	1.25	97	1.20	1.35	139	1.20	1.50	181	1.50	1.25
14	1.40	1.15	56	1.25	1.40	98	1.10	1.50	140	1.20	1.50	182	1.30	1.55
15	1.50	1.25	57	1.25	1.50	99	1.20	1.35	141	0.85	1.20	183	1.35	1.45
16	1.55	1.10	58	1.15	1.60	100	1.15	1.50	142	1.35	1.35	184	1.45	1.45
17	1.45	1.35	59	1.15	1.50	101	1.10	1.45	143	1.30	1.30	185	1.35	1.20
18	1.20	1.40	60	1.30	1.35	102	1.40	1.50	144	1.45	1.60	186	1.35	1.45
19	1.25	1.25	61	1.25	1.45	103	1.50	1.40	145	1.50	1.60	187	1.20	1.30
20	1.25	1.40	62	1.35	1.25	104	1.60	1.20	146	1.40	1.30	188	1.30	1.50
21	1.30	1.45	63	1.20	1.45	105	1.35	1.25	147	1.35	1.30	189	1.35	1.65
22	1.30	1.45	64	1.30	1.40	106	1.25	1.45	148	1.55	1.30	190	1.30	1.30
23	1.50	1.40	65	1.25	1.40	107	1.25	1.60	149	1.30	1.25	191	1.35	1.40
24	1.15	1.45	66	1.30	1.40	108	1.40	1.25	150	1.60	1.25	192	0.90	1.40
25	1.10	1.40	67	1.20	1.30	109	1.45	1.45	151	1.25	1.60	193	1.40	1.30
26	1.20	1.35	68	1.15	1.45	110	1.25	1.45	152	1.35	1.40	194	1.35	1.40
27	1.25	1.25	69	1.25	1.40	111	1.15	1.55	153	1.20	1.50	195	1.45	1.10
28	1.05	1.40	70	1.15	1.40	112	1.15	1.70	154	1.45	1.30	196	1.25	1.15
29	1.20	1.40	71	1.35	1.25	113	1.35	1.65	155	1.65	0.80	197	1.05	1.55
30	1.05	1.40	72	1.40	1.40	114	1.45	1.40	156	1.25	1.35	198	1.25	1.60
31	1.05	1.40	73	1.50	1.20	115	1.45	1.30	157	1.50	1.20	199	1.55	1.30
32	1.05	1.50	74	1.25	1.35	116	1.30	1.35	158	1.25	1.60	200	1.20	1.10
33	1.00	1.55	75	1.35	1.30	117	1.40	1.40	159	1.20	1.50	201	1.35	1.40
34	1.25	1.20	76	1.15	1.45	118	1.25	1.50	160	1.30	1.50	202	1.15	1.20
35	1.30	1.35	77	0.90	1.30	119	1.25	1.65	161	1.20	1.40	203	1.25	1.35
36	1.30	1.30	78	1.15	1.55	120	1.30	1.45	162	1.35	1.30	204	1.40	1.30
37	1.25	1.40	79	1.25	1.40	121	1.30	1.50	163	1.35	1.35	205	1.30	1.35
38	1.25	1.30	80	1.30	1.40	122	1.10	1.55	164	1.15	1.35	206	1.25	1.30
39	1.20	1.35	81	1.25	1.55	123	1.25	1.40	165	1.30	1.40	207	1.30	1.20
40	1.25	1.50	82	1.30	1.35	124	1.25	1.50	166	1.35	1.30	208	1.20	1.40
41	1.35	1.45	83	1.25	1.45	125	1.20	1.60	167	1.30	1.10	209	1.10	1.30
42	1.30	1.45	84	1.15	1.30	126	1.30	1.30	168	1.30	0.95			

Appendix 8c :Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N3

Tooth No.	In	Out	Tooth No.	In	Out	Tooth No.	In	Out	Tooth No	In	Out	Tooth No.	In	Out
1	0.85	1.50	43	1.15	1.20	85	0.95	1.30	127	1.20	1.20	169	1.40	1.15
2	1.10	1.30	44	1.00	1.40	86	1.10	1.10	128	1.05	1.20	170	1.55	1.20
3	1.00	1.25	45	0.55	1.20	87	1.20	1.50	129	1.10	1.30	171	1.30	1.10
4	1.05	1.25	46	1.20	1.60	88	0.90	1.40	130	1.05	1.30	172	1.30	1.20
5	1.10	1.20	47	1.20	1.40	89	1.00	1.20	131	1.05	1.30	173	1.20	1.10
6	0.95	1.10	48	1.35	1.35	90	1.20	0.95	132	0.95	1.15	174	1.25	1.40
7	1.15	1.20	49	1.30	1.15	91	1.35	1.30	133	1.05	1.30	175	1.25	1.35
8	1.10	1.40	50	1.25	1.20	92	1.00	1.40	134	1.20	1.60	176	1.10	1.05
9	0.95	1.40	51	1.00	1.25	93	1.20	1.40	135	1.25	1.20	177	1.50	1.20
10	0.85	1.40	52	1.20	1.15	94	1.20	1.10	136	1.05	1.20	178	1.00	1.00
11	1.20	1.35	53	1.25	1.30	95	1.20	1.25	137	1.35	1.20	179	1.10	1.40
12	0.80	1.65	54	1.30	1.35	96	1.10	1.20	138	1.40	1.30	180	1.20	1.25
13	1.50	0.95	55	1.15	1.15	97	1.30	1.20	139	1.35	1.45	181	1.25	1.15
14	1.25	1.10	56	1.15	1.35	98	1.45	1.50	140	1.05	1.20	182	1.15	1.45
15	1.20	1.20	57	1.45	1.35	99	1.20	1.40	141	1.15	1.30	183	1.20	1.20
16	1.45	1.00	58	1.35	0.85	100	1.10	1.40	142	0.80	1.25	184	1.30	1.40
17	1.35	1.15	59	1.25	0.90	101	1.10	1.30	143	1.30	1.30	185	1.25	1.20
18	1.05	1.30	60	1.10	1.20	102	1.00	1.20	144	1.20	1.40	186	1.15	1.25
19	1.15	1.25	61	1.30	1.35	103	1.30	1.25	145	1.35	1.15	187	1.25	1.50
20	1.15	1.20	62	1.00	1.15	104	1.40	1.35	146	1.50	1.20	188	1.15	1.20
21	1.10	1.30	63	1.10	1.45	105	1.50	1.45	147	1.30	1.25	189	1.30	1.30
22	1.35	1.10	64	1.05	1.40	106	1.20	1.10	148	1.20	1.20	190	1.15	1.35
23	1.10	1.00	65	1.10	1.35	107	1.15	1.30	149	1.35	1.10	191	1.20	1.35
24	1.10	1.40	66	1.10	1.30	108	1.15	1.30	150	1.35	0.85	192	0.90	1.35
25	1.00	1.20	67	1.05	1.30	109	1.20	1.30	151	1.55	1.10	193	1.15	1.35
26	1.05	1.15	68	1.20	1.30	110	1.40	1.45	152	1.65	1.55	194	1.15	1.45
27	0.95	1.20	69	1.10	1.35	111	1.30	1.50	153	1.30	1.30	195	1.40	1.50
28	0.95	1.25	70	1.25	1.20	112	1.15	1.25	154	1.10	1.30	196	1.45	1.50
29	1.00	1.25	71	1.30	1.20	113	1.05	1.25	155	0.70	1.10	197	1.20	1.20
30	1.15	1.15	72	1.40	1.30	114	1.30	1.25	156	1.00	1.35	198	1.10	0.95
31	1.45	0.95	73	1.15	1.10	115	1.30	1.30	157	1.25	1.15	199	1.20	1.20
32	1.30	0.65	74	1.40	1.20	116	1.30	1.45	158	1.50	1.45	200	1.55	1.10
33	1.30	0.85	75	1.05	1.10	117	1.35	1.35	159	1.30	1.30	201	1.20	1.35
34	1.30	0.75	76	0.85	1.40	118	1.30	1.35	160	1.30	1.30	202	1.45	1.20
35	1.15	1.15	77	1.10	1.20	119	1.25	1.20	161	1.20	1.30	203	1.15	1.20
36	1.20	1.10	78	1.10	1.45	120	1.15	1.40	162	1.15	1.20	204	1.25	1.15
37	1.15	1.10	79	1.05	1.40	121	1.40	1.15	163	1.30	1.30	205	1.30	1.10
38	1.15	1.20	80	1.25	1.10	122	1.20	1.45	164	1.25	1.20	206	1.15	1.20
39	1.15	1.10	81	1.30	1.20	123	1.40	1.50	165	1.15	1.00	207	1.20	1.35
40	1.20	1.30	82	1.20	1.20	124	1.35	1.50	166	1.30	1.05	208	1.25	1.20
41	1.15	1.30	83	1.15	1.40	125	1.35	1.00	167	1.30	1.00	209	1.00	1.10
42	1.15	1.15	84	0.95	1.30	126	1.05	1.20	168	1.30	0.80			

Appendix 8d : Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N4

Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out
1	0.50	1.20	43	1.15	1.10	85	1.15	1.20	127	0.95	0.80	169	1 00	1 00
2	0.85	1 20	44	1.10	1.30	86	1.05	1.20	128	0.75	1.30	170	1.25	1.10
3	0.80	1 10	45	0.75	1.35	87	0.95	1.20	129	0.90	0.95	171	1.30	1 20
4	0.70	1.95	46	0.70	1.05	88	0 80	1.35	130	1.00	1.05	172	1 25	1 15
5	0.85	1.00	47	1.10	1.25	89	0.85	1.00	131	1.00	1.05	173	1 25	1 05
6	0.85	1.05	48	1.10	1.30	90	0.95	0.80	132	0.90	1.10	174	1 00	1 45
7	1.05	1.15	49	1.15	1.05	91	1.20	1 10	133	1.20	0.65	175	1 20	1 35
8	0.95	1.20	50	1.15	1.05	92	1.00	0.80	134	0.75	1.05	176	0 95	1 20
9	0.80	1.25	51	1.10	1.05	93	1.20	1.20	135	1.20	0.90	177	1 00	1 10
10	1.15	0.65	52	1.00	0.85	94	1.10	1.20	136	1.15	1.15	178	1 30	1 00
11	0.90	1.20	53	1.00	1.00	95	1.10	1.25	137	1.00	1.25	179	0 95	1 30
12	0.60	0.55	54	1.05	1.30	96	1.05	0.90	138	1.15	1.20	180	1 05	1 00
13	1 25	0.95	55	1.30	1.10	97	1.00	1.20	139	1.15	1.10	181	1 20	1 05
14	1.15	1.00	56	1.10	1.20	98	1.25	1.20	140	1.20	1.05	182	0 95	1 10
15	1.15	1.10	57	1.00	1.25	99	1.30	1.00	141	1.05	1.20	183	1.25	0 90
16	1.30	1.00	58	0 85	0.25	100	1.25	1.20	142	0.95	1.20	184	1 25	1 20
17	1 20	1.20	59	0 05	0.85	101	1.05	1.30	143	0 75	1.00	185	1 20	0.90
18	0.95	1 20	60	1 10	0.90	102	1.05	1.00	144	0.80	0.70	186	1 30	1.20
19	0.95	1 10	61	1.05	1 10	103	0 90	1.20	145	1 15	0.85	187	1 05	1 15
20	1.00	1 25	62	1.25	0 85	104	1 30	1.15	146	1 30	1.10	188	1 00	1 20
21	0.65	1.50	63	1.00	1.05	105	1.30	1.70	147	1 10	1.40	189	1 10	1.35
22	1.00	1.05	64	1.10	1.05	106	1.40	1.15	148	1.15	0.95	190	1 00	1.10
23	0.30	1.30	65	1.00	1 10	107	1 10	1.25	149	1 10	1 05	191	1.20	1 35
24	1.00	1.30	66	0.70	1.25	108	1.05	1.00	150	1.20	1.10	192	0 95	1 35
25	0.85	1.30	67	1.10	1.35	109	1.20	1.15	151	1.20	0.95	193	1.00	1.30
26	0.80	1.30	68	1.05	1.10	110	1.15	1.30	152	1.45	0.90	194	0.95	1.35
27	0.90	1.10	69	0.75	1 50	111	1.20	1.20	153	1.60	0.60	195	1.05	1.10
28	0.80	1.20	70	1.05	1 50	112	1.10	1.20	154	1.30	0.90	196	1 25	1 10
29	1.00	1 20	71	1.20	1.10	113	1.05	1.20	155	0.95	1.40	197	1.25	1 15
30	1.00	1 10	72	1 25	1.05	114	0 85	1.40	156	0.95	0.85	198	1 10	1 30
31	1 25	0 60	73	1.35	0 95	115	0.95	1.20	157	1.30	0.00	199	0 90	1 40
32	0.40	0 40	74	1.00	1 15	116	1.20	0.95	158	1.20	1.05	200	1 15	1.05
33	0.85	0.60	75	1.20	0.90	117	1 25	1.35	159	1 45	0.95	201	1.30	0.90
34	1.15	0.70	76	0.90	1.35	118	1.25	1.45	160	1.15	1.35	202	1.00	1.15
35	1.15	1 15	77	0.95	1.10	119	1.15	1.45	161	1.05	1 20	203	1.20	0.95
36	0.95	1.10	78	0.95	1.30	120	1.10	1.30	162	0.90	1.25	204	1.05	1.15
37	1.10	1.05	79	0.95	1.00	121	1.05	1.25	163	0.90	1.20	205	1.05	1.15
38	0.80	1.40	80	0.95	1.20	122	1.25	0.40	164	1.15	1.05	206	1.15	1.10
39	1.05	1.05	81	1.10	1.20	123	1.00	0.35	165	1 15	1.15	207	1.00	1.00
40	1.10	1.20	82	1.00	1.00	124	1.05	0.20	166	1.00	1.05	208	0.05	1.00
41	1.10	1.10	83	1.00	1.40	125	1.15	0.20	167	1.15	1.15	209	1.00	0.85
42	1.05	1.05	84	1.05	1.00	126	1.20	0.95	168	1.20	1.10			

Appendix 8e :Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N5

Tooth No.	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No.	In	Out	Tooth No	In	Out
1	0.10	0.45	43	1.05	0.90	85	0.75	0.95	127	0.65	0.90	169	0.75	0.90
2	0.85	0.90	44	0.85	1.10	86	0.00	0.50	128	0.90	0.95	170	0.00	0.80
3	0.10	1.00	45	0.75	0.90	87	0.00	0.80	129	0.95	0.85	171	0.65	0.00
4	0.55	0.95	46	0.60	0.60	88	0.80	1.10	130	1.05	0.85	172	0.90	0.55
5	0.70	0.85	47	0.95	1.05	89	0.95	0.90	131	0.85	1.15	173	1.00	0.70
6	0.75	0.90	48	1.00	1.05	90	1.05	0.45	132	0.70	1.00	174	1.15	0.75
7	0.90	0.95	49	0.90	1.00	91	0.80	0.80	133	0.50	0.75	175	0.70	0.25
8	1.00	0.70	50	0.90	0.90	92	1.00	0.55	134	1.05	0.75	176	0.80	0.75
9	0.60	0.60	51	0.55	0.35	93	0.85	1.00	135	0.85	0.90	177	1.15	0.15
10	1.20	0.00	52	0.90	0.70	94	0.85	1.10	136	1.05	1.10	178	1.25	0.80
11	0.95	0.85	53	0.75	0.80	95	1.15	0.70	137	0.95	0.85	179	0.85	0.20
12	0.40	1.05	54	0.10	1.00	96	0.65	0.95	138	0.95	1.05	180	0.80	0.95
13	0.75	1.20	55	0.25	0.75	97	1.05	1.00	139	0.80	0.90	181	0.60	0.80
14	1.00	0.95	56	0.80	0.75	98	1.00	0.65	140	1.10	0.85	182	1.10	0.90
15	0.85	1.00	57	0.75	1.05	99	0.70	0.45	141	0.95	0.95	183	1.00	0.65
16	1.10	0.85	58	0.40	0.70	100	0.80	0.90	142	1.25	0.70	184	1.00	0.85
17	1.00	0.95	59	0.00	0.75	101	0.75	1.00	143	0.90	0.75	185	1.25	0.60
18	0.80	0.85	60	0.85	0.90	102	0.65	0.90	144	0.85	0.95	186	0.90	1.00
19	0.90	0.80	61	0.80	0.90	103	1.00	0.80	145	0.70	0.00	187	0.90	0.90
20	0.65	1.10	62	0.00	1.00	104	1.00	0.75	146	0.45	0.45	188	0.80	1.00
21	0.70	0.90	63	0.50	1.15	105	1.20	1.05	147	0.85	0.95	189	0.95	0.00
22	1.20	0.40	64	0.80	0.95	106	0.90	1.00	148	1.15	0.75	190	1.00	0.55
23	1.00	0.95	65	0.80	0.90	107	0.95	1.10	149	0.85	1.20	191	1.10	0.75
24	0.80	1.15	66	0.65	1.15	108	1.05	1.05	150	0.80	1.00	192	1.05	0.65
25	0.60	1.00	67	0.80	0.85	109	0.65	0.50	151	0.90	0.95	193	0.90	0.90
26	0.75	0.70	68	1.40	0.35	110	1.00	1.15	152	0.65	1.00	194	1.00	0.95
27	0.50	0.85	69	0.15	1.10	111	1.00	0.75	153	0.90	0.85	195	0.90	0.70
28	0.90	0.60	70	0.85	0.35	112	0.75	0.75	154	0.90	1.00	196	0.60	0.75
29	0.75	0.55	71	0.90	0.70	113	1.10	1.00	155	0.90	0.95	197	0.60	0.60
30	0.35	0.00	72	0.70	1.00	114	1.00	0.90	156	1.00	1.00	198	0.25	0.80
31	0.30	0.00	73	1.00	0.90	115	0.85	1.15	157	1.10	0.80	199	0.15	0.50
32	0.20	0.00	74	0.70	0.95	116	1.15	0.55	158	0.90	0.80	200	1.00	0.95
33	0.00	0.30	75	1.10	0.55	117	0.95	0.70	159	0.95	0.65	201	0.75	0.80
34	0.00	0.80	76	0.75	0.95	118	0.35	0.55	160	0.90	0.95	202	0.85	0.90
35	0.30	0.40	77	0.85	0.80	119	0.50	0.95	161	1.15	1.05	203	0.75	0.45
36	0.00	0.35	78	0.75	1.10	120	0.25	1.00	162	0.85	0.65	204	0.95	0.85
37	0.55	0.90	79	0.65	1.00	121	0.75	0.85	163	0.35	1.00	205	0.40	0.80
38	0.85	0.75	80	0.70	0.80	122	1.00	0.60	164	1.10	1.00	206	0.50	0.90
39	0.75	0.75	81	0.75	0.75	123	1.00	0.80	165	0.35	0.75	207	0.55	1.05
40	0.80	1.05	82	0.85	0.75	124	1.00	0.85	166	0.70	1.10	208	0.95	1.15
41	0.90	0.90	83	0.60	1.05	125	1.00	0.55	167	1.00	1.00	209	0.55	0.95
42	0.75	0.95	84	0.70	0.85	126	1.20	0.60	168	0.90	0.85			

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Appendix 8f : Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N6

Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out	Tooth No	In	Out
1	0.00	0.35	43	0.90	0.75	85	0.00	0.40	127	0.75	0.80	169	0.60	0.60
2	0.70	0.75	44	0.70	0.90	86	0.00	0.60	128	0.80	0.70	170	0.00	0.00
3	0.00	0.85	45	0.60	0.75	87	0.65	0.90	129	0.90	0.70	171	0.50	0.40
4	0.45	0.80	46	0.45	0.45	88	0.30	0.75	130	0.70	1.00	172	0.75	0.50
5	0.55	0.70	47	0.80	0.90	89	0.90	0.35	131	0.60	0.85	173	0.85	0.60
6	0.60	0.75	48	0.85	0.85	90	0.65	0.65	132	0.40	0.60	174	1.00	0.10
7	0.75	0.80	49	0.75	0.80	91	0.85	0.45	133	0.90	0.60	175	0.55	0.60
8	0.85	0.60	50	0.75	0.70	92	0.60	0.85	134	0.70	0.75	176	0.65	0.05
9	0.45	0.45	51	0.45	0.15	93	0.70	0.95	135	0.90	0.90	177	1.00	0.60
10	1.05	0.00	52	0.70	0.50	94	1.00	0.55	136	0.80	0.70	178	1.10	0.10
11	0.75	0.70	53	0.60	0.60	95	0.40	0.80	137	0.80	0.85	179	0.70	0.80
12	0.30	0.90	54	0.00	0.80	96	0.90	0.85	138	0.70	0.70	180	0.65	0.65
13	0.60	1.05	55	0.15	0.55	97	0.85	0.50	139	0.95	0.80	181	0.45	0.75
14	0.85	0.80	56	0.65	0.50	98	0.50	0.35	140	0.80	0.75	182	0.85	0.50
15	0.70	0.85	57	0.60	0.80	99	0.65	0.75	141	1.10	0.55	183	0.85	0.70
16	0.95	0.70	58	0.30	0.50	100	0.60	0.85	142	0.75	0.60	184	1.10	0.45
17	0.85	0.80	59	0.00	0.70	101	0.50	0.75	143	0.70	0.80	185	0.75	0.85
18	0.65	0.70	60	0.65	0.85	102	0.85	0.65	144	0.55	0.00	186	0.75	0.75
19	0.75	0.80	61	0.65	0.80	103	0.80	0.60	145	0.30	0.35	187	0.65	0.85
20	0.50	0.90	62	0.00	1.00	104	1.05	0.90	146	0.70	0.85	188	0.75	0.00
21	0.65	0.70	63	0.30	0.80	105	0.75	0.80	147	1.00	0.55	189	0.85	0.30
22	1.05	0.20	64	0.65	0.75	106	0.80	0.90	148	0.70	1.00	190	0.95	0.60
23	0.85	0.80	65	0.65	1.00	107	0.90	0.90	149	0.65	0.90	191	0.90	0.50
24	0.65	1.00	66	0.50	0.65	108	0.50	0.40	150	0.75	0.80	192	0.75	0.70
25	0.45	0.85	67	0.65	0.20	109	0.85	1.00	151	0.50	0.85	193	0.85	0.70
26	0.60	0.60	68	1.10	0.90	110	0.80	0.60	152	0.75	0.65	194	0.60	0.75
27	0.40	0.70	69	0.70	0.15	111	0.60	0.55	153	0.75	0.85	195	0.45	0.60
28	0.75	0.45	70	0.75	0.55	112	0.95	0.85	154	0.75	0.85	196	0.45	0.55
29	0.60	0.45	71	0.55	0.85	113	0.85	0.70	155	0.85	1.00	197	0.15	0.75
30	0.25	0.00	72	0.85	0.70	114	0.70	1.00	156	0.95	0.70	198	0.00	0.40
31	0.20	0.00	73	0.55	0.70	115	1.00	0.40	157	0.75	0.65	199	0.80	0.75
32	0.10	0.00	74	0.95	0.45	116	0.80	0.55	158	0.80	0.90	200	0.60	0.65
33	0.00	0.15	75	0.60	0.75	117	0.20	0.40	159	0.30	0.75	201	0.70	0.70
34	0.00	0.25	76	0.70	0.60	118	0.35	0.80	160	0.65	0.45	202	0.60	0.35
35	0.10	0.20	77	0.65	0.90	119	0.10	0.85	161	0.65	0.00	203	0.80	0.70
36	0.00	0.75	78	0.40	0.90	120	0.60	0.70	162	0.50	0.85	204	0.30	0.65
37	0.45	0.60	79	0.55	0.65	121	0.85	0.40	163	0.65	0.80	205	0.40	0.75
38	0.70	0.60	80	0.60	0.60	122	0.90	0.60	164	1.10	0.70	206	0.40	0.80
39	0.60	0.80	81	0.70	0.65	123	0.85	0.70	165	0.70	0.15	207	0.50	0.70
40	0.65	0.70	82	0.45	0.80	124	0.85	0.40	166	0.75	0.50	208	0.55	0.55
41	0.75	0.80	83	0.55	0.70	125	1.05	0.45	167	0.55	0.60	209	0.95	0.50
42	0.60	0.75	84	0.95	0.70	126	0.75	0.65	168	0.85	0.80			

Appendix 8g :Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N7

Tooth No.	In	Out	Tooth No.	In	Out	Tooth No.	In	Out	Tooth No.	In	Out	Tooth No.	In	Out
1	0.15	0.00	43	0.55	0.40	85	0.40	0.80	127	0.15	0.10	169	0.50	0.10
2	0.55	0.45	44	0.30	0.40	86	0.60	0.00	128	0.50	0.60	170	0.65	0.20
3	0:65	0.00	45	0.00	0.00	87	0.55	0.40	129	0.60	0.65	171	0.45	0.20
4	0.60	0.25	46	0.20	0.25	88	0.50	0.50	130	0.50	0.35	172	0.45	0.35
5	0.55	0.35	47	0.30	0.50	89	0.20	0.35	131	0.45	0.45	173	0.80	0.55
6	0.60	0.45	48	0.45	0.55	90	0.50	0.55	132	0.35	0.40	174	0.60	0.55
7	0.65	0.45	49	0.00	0.70	91	0.40	0.45	133	0.65	0.35	175	0.40	0.60
8	0.45	0.55	50	0.35	0.35	92	0.65	0.65	134	0.50	0.60	176	0.35	0.50
9	0.35	0.25	51	0.00	0.40	93	0.70	0.50	135	0.65	0.60	177	0.55	0.40
10	0.00	0.80	52	0.40	0.75	94	0.45	0.50	136	0.60	0 80	178	0.65	0.20
11	0.50	0.45	53	0.00	0.75	95	0.40	0.40	137	0 15	0.55	179	0.50	0.60
12	0.70	0 10	54	0 55	0.45	96	0.35	0.30	138	0.75	0.55	180	0.60	0.50
13	0.80	0.40	55	0.50	0.40	97	0.55	0.35	139	0.35	0.70	181	0.50	0.70
14	0.75	0.55	56	0 55	0.25	98	0.45	0.40	140	0.35	0 30	182	0.60	0.60
15	0.60	0.45	57	0.70	0.65	99	0.40	0.55	141	0.60	0.60	183	0.55	0.65
16	0.50	0.65	58	0.55	0.50	100	0.30	0.20	142	0.45	0.55	184	0.50	0.45
17	0.55	0.40	59	0.35	0.40	101	0.45	0.40	143	0.70	0.40	185	0.35	0.75
18	0.50	0.45	60	0.00	0 20	102	0.30	0.70	144	0 10	0.65	186	0.40	0.60
19	0.40	0 55	61	0.65	0.50	103	0.50	0.60	145	0 25	0 60	187	0.65	0.80
20	0.70	0.30	62	0.60	0 50	104	0.50	0.70	146	0.15	0.50	188	0.00	0 55
21	0.45	0.45	63	0.55	0.45	105	0.65	0.80	147	0 60	0 80	189	0 15	0 45
22	0.00	0 70	64	0.00	0 50	106	0.00	0.60	148	0.60	0.60	190	0 65	0 40
23	0.60	0.65	65	0 40	0.45	107	0.10	0.60	149	0.45	0.00	191	0.35	0.10
24	0.75	0.45	66	0 35	0 15	108	0.40	0.40	150	0.15	0.05	192	0.75	0.50
25	0.65	0 20	67	0 65	0 40	109	0.40	0.50	151	0.40	0 00	193	0.65	0.70
26	0.60	0.35	68	0 40	0 40	110	0.30	0.55	152	0.55	0 40	194	0.55	0.55
27	0.50	0.20	69	0 30	0 00	111	0.40	0.70	153	0.10	0.60	195	0.75	0.45
28	0.30	0.60	70	0.55	0.00	112	0.50	0.60	154	0.15	0.65	196	0.40	0.50
29	0.25	0 40	71	0 35	0 40	113	0.20	0 60	155	0 40	0.65	197	0.60	0.55
30	0.00	0 00	72	0 40	0 45	114	0.35	0.60	156	0 35	0 60	198	0.55	0.55
31	0.00	0.05	73	0.55	0 15	115	0.65	0.35	157	0 35	0.80	199	0.80	0.50
32	0.00	0 00	74	0.65	0 05	116	0.50	0.00	158	0.55	0.50	200	0.45	0.60
33	0 00	0.05	75	0 60	0 40	117	0.15	0.00	159	0.20	0 10	201	0.40	0.65
34	0.05	0.00	76	0.80	0.35	118	0.25	0.40	160	0.50	0.15	202	0.35	0.55
35	0.05	0.00	77	0.60	0.00	119	0.20	0.55	161	0.45	0.00	203	0.40	0.60
36	0.50	0.00	78	0.55	0.10	120	0.60	0.65	162	0.40	0.00	204	0.65	0.80
37	0.40	0.20	79	0.75	0.40	121	0.70	0.45	163	0.15	0.60	205	0.00	0.55
38	0.40	0.40	80	0.50	0.35	122	0.35	0.65	164	0.45	0.40	206	0.15	0.45
39	0.55	0.40	81	0.00	0.25	123	0.60	0.40	165	0.45	0.50	207	0.65	0.40
40	0.55	0.35	82	0.65	0.35	124	0.60	0.55	166	0.40	0.45	208	0.35	0.10
41	0.50	0 45	83	0.00	0.40	125	0.20	0.80	167	0.60	0.55	209	0.75	0.50
42	0 60	0 50	84	0.65	0.70	126	0.55	0.55	168	0.75	0.45			

Appendix 8h: Inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N8

Tooth No.	Out	In	Tooth No.	Out	In	Tooth No.	Out	In	Tooth No	Out	In	Tooth No:	Out	In
1	0.00	0.00	43	0 20	0.10	85	0.20	0 40	127	0.10	0.35	169	0.35	0.30
2	0.10	0.35	44	0.00	0.00	86	0.30	0.20	128	0.15	0.15	170	0.30	0.10
3	0.00	0.40	45	0.05	0.00	87	0.15	0.05	129	0.20	0.35	171	0.30	0.05
4	0.15	0.35	46	0.20	0.10	88	0.40	0.10	130	0.10	0.30	172	0.15	0.30
5	0.05	0.20	47	0.35	0.15	89	0.20	0.10	131	0.35	0.35	173	0.05	0.40
6	0.20	0.35	48	0.40	0.00	90	0.40	0.25	132	0.40	0.35	174	0.40	0.20
7	0.25	0.40	49	0.15	0.15	91	0.30	0.40	133	0.55	0.00	175	0.30	0.45
8	0.35	0.25	50	0.25	0.00	92	0.40	0.25	134	0.30	0.50	176	0.50	0.25
9	0.15	0.10	51	0.55	0.10	93	0.15	0.10	135	0.25	0.10	177	0.35	0.30
10	0.45	0.00	52	0.45	0.00	94	0.10	0 15	136	0.55	0.05	178	0.45	0.30
11	0 25	0.30	53	0 15	0.35	95	0.25	0 25	137	0 10	0 40	179	0.45	0.25
12	0.00	0.50	54	0.10	0 25	96	0 10	0 25	138	0 40	0.25	180	0.20	0.05
13	0.10	0.55	55	0.15	0.30	97	0.35	0 10	139	0.35	0.40	181	0.50	0.10
14	0.35	0.50	56	0.40	0 45	98	0 05	0 10	140	0 15	0.00	182	0.35	0.40
15	0.20	0.40	57	0.30	0.35	99	0.15	0 10	141	0.40	0 00	183	0.55	0.00
16	0.45	0.30	58	0.20	0.00	100	0.45	0.10	142	0.40	0.00	184	0.35	0.00
17	0.10	0.35	59	0.10	0.00	101	0.35	0.20	143	0.25	0.30	185	0.15	0 40
18	0.25	0.30	60	0 30	0.25	102	0.45	0.15	144	0.50	0.35	186	0.10	0.10
19	0.35	0.20	61	0.25	0.35	103	0 50	0 30	145	0.35	0.15	187	0.00	0.45
20	0.10	0 50	62	0 35	0.15	104	0 35	0 00	146	0.00	0 00	188	0.20	0.40
21	0.20	0 25	63	0 30	0.00	105	0 40	0 10	147	0.00	0 10	189	0.45	0.30
22	0 45	0.00	64	0 25	0 10	106	0 25	0 10	148	0.00	0 30	190	0.35	0.50
23	0.45	0.35	65	0 00	0.05	107	0.30	0 15	149	0 20	0 00	191	0.15	0.10
24	0.25	0.50	66	0.10	0 35	108	0 35	0 05	150	0 30	0.00	192	0.10	0.35
25	0.05	0.45	67	0.20	1.00	109	0.45	0 10	151	0.40	0.15	193	0.30	0.35
26	0.15	0.40	68	0.00	0 05	110	0.30	0 15	152	0.35	0.15	194	0.35	0.45
27	0.05	0.30	69	0.00	0.35	111	0.35	0.00	153	0.35	0.10	195	0.20	0.10
28	0.30	0.05	70	0.20	0.25	112	0.40	0 15	154	0.55	0.30	196	0.35	0.10
29	0.20	0.10	71	0.25	0.10	113	0.15	0.45	155	0.20	0.00	197	0.30	0.10
30	0.00	0.00	72	0.00	0.35	114	0.00	0.10	156	0.00	0.20	198	0.30	0.25
31	0.00	0.00	73	0.00	0.35	115	0.00	0.00	157	0.00	0.25	199	0.25	0.35
32	0.00	0.00	74	0.20	0.40	116	0 15	0 00	158	0.00	0.20	200	0.55	0.00
33	0.00	0.00	75	0.15	0.45	117	0.35	0 00	159	0.30	0.00	201	0.35	0.00
34	0.00	0.00	76	0.00	0.35	118	0.40	0 35	160	0.10	0.10	202	0.15	0.40
35	0.00	0.00	77	0.00	0.25	119	0 20	0.40	161	0.30	0.15	203	0.10	0.10
36	0.00	0.20	78	0.20	0.35	120	0.40	0 15	162	0 25	0.10	204	0.00	0.45
37	0.10	0.15	79	0.15	0 40	121	0 15	0.25	163	0.35	0.30	205	0.20	0.40
38	0.15	0.15	80	0.15	0.00	122	0.30	0 30	164	0.00	0.25	206	0.45	0.30
39	0.20	0.20	81	0.15	0.35	123	0.55	0.05	165	0.00	0.30	207	0.35	0.50
40	0.15	0.25	82	0.20	0.00	124	0.00	0 00	166	0.05	0.20	208	0.15	0.10
41	0.25	0.30	83	0.60	0 10	125	0.35	0 30	167	0.15	0.20	209	0.10	0.35
42	0.20	0.20	84	0.00	0.35	126	0.40	0 40	168	0.30	0.50			

Appendix 8i: inner and Outer Side Clearance (mm) of Stellite-Tipped Saw N9

Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In	Tooth No	Out	In
1	0.00	0.00	43	0.05	0.05	85	0.10	0.30	127	0.10	0.30	169	0.35	0.20
2	0.00	0.25	44	0.00	0.00	86	0.20	0.15	128	0.05	0.25	170	0.30	0.15
3	0.00	0.30	45	0.00	0.00	87	0.10	0.00	129	0.10	0.05	171	0.15	0.20
4	0.05	0.25	46	0.10	0.05	88	0.30	0.05	130	0.05	0.00	172	0.00	0.10
5	0.00	0.10	47	0.15	0.10	89	0.10	0.00	131	0.20	0.20	173	0.30	0.10
6	0.10	0.30	48	0.20	0.00	90	0.30	0.20	132	0.30	0.20	174	0.25	0.30
7	0.15	0.30	49	0.10	0.05	91	0.20	0.20	133	0.40	0.15	175	0.45	0.20
8	0.20	0.15	50	0.15	0.00	92	0.30	0.15	134	0.20	0.20	176	0.30	0.10
9	0.05	0.05	51	0.40	0.05	93	0.10	0.05	135	0.20	0.00	177	0.40	0.05
10	0.20	0.00	52	0.25	0.00	94	0.00	0.10	136	0.30	0.40	178	0.10	0.20
11	0.10	0.10	53	0.15	0.15	95	0.15	0.05	137	0.05	0.00	179	0.40	0.30
12	0.00	0.30	54	0.05	0.15	96	0.00	0.05	138	0.30	0.00	180	0.30	0.20
13	0.10	0.40	55	0.15	0.20	97	0.25	0.10	139	0.25	0.30	181	0.40	0.35
14	0.25	0.40	56	0.25	0.35	98	0.00	0.05	140	0.05	0.20	182	0.30	0.20
15	0.10	0.30	57	0.10	0.30	99	0.05	0.05	141	0.30	0.30	183	0.00	0.25
16	0.20	0.20	58	0.20	0.00	100	0.35	0.10	142	0.20	0.00	184	0.00	0.20
17	0.05	0.25	59	0.05	0.00	101	0.20	0.10	143	0.15	0.00	185	0.00	0.20
18	0.15	0.20	60	0.20	0.20	102	0.25	0.05	144	0.40	0.00	186	0.15	0.00
19	0.20	0.15	61	0.20	0.25	103	0.30	0.20	145	0.25	0.20	187	0.35	0.05
20	0.00	0.40	62	0.25	0.05	104	0.25	0.00	146	0.00	0.25	188	0.25	0.30
21	0.05	0.15	63	0.20	0.00	105	0.20	0.05	147	0.00	0.05	189	0.10	0.00
22	0.30	0.00	64	0.15	0.05	106	0.15	0.10	148	0.00	0.00	190	0.05	0.00
23	0.35	0.25	65	0.00	0.00	107	0.10	0.10	149	0.10	0.10	191	0.20	0.30
24	0.10	0.35	66	0.05	0.25	108	0.15	0.00	150	0.20	0.20	192	0.20	0.10
25	0.00	0.25	67	0.10	0.05	109	0.25	0.10	151	0.30	0.00	193	0.05	0.35
26	0.10	0.20	68	0.00	0.00	110	0.20	0.10	152	0.25	0.00	194	0.20	0.30
27	0.00	0.15	69	0.00	0.30	111	0.25	0.00	153	0.25	0.05	195	0.25	0.20
28	0.20	0.05	70	0.10	0.15	112	0.20	0.05	154	0.40	0.10	196	0.20	0.40
29	0.10	0.00	71	0.15	0.05	113	0.00	0.10	155	0.20	0.00	197	0.20	0.00
30	0.00	0.00	72	0.00	0.20	114	0.00	0.30	156	0.00	0.10	198	0.40	0.30
31	0.00	0.00	73	0.00	0.20	115	0.00	0.05	157	0.00	0.10	199	0.20	0.30
32	0.00	0.00	74	0.10	0.30	116	0.15	0.00	158	0.00	0.10	200	0.00	0.30
33	0.00	0.00	75	0.05	0.35	117	0.30	0.00	159	0.20	0.00	201	0.00	0.05
34	0.00	0.00	76	0.00	0.25	118	0.30	0.00	160	0.10	0.20	202	0.20	0.00
35	0.00	0.00	77	0.00	0.15	119	0.10	0.20	161	0.20	0.00	203	0.20	0.10
36	0.00	0.10	78	0.10	0.20	120	0.30	0.30	162	0.15	0.10	204	0.00	0.00
37	0.05	0.05	79	0.05	0.30	121	0.10	0.05	163	0.25	0.15	205	0.00	0.10
38	0.05	0.05	80	0.10	0.00	122	0.20	0.15	164	0.00	0.10	206	0.15	0.10
39	0.10	0.10	81	0.00	0.25	123	0.40	0.20	165	0.00	0.00	207	0.20	0.05
40	0.00	0.15	82	0.10	0.00	124	0.00	0.00	166	0.00	0.10	208	0.35	0.20
41	0.10	0.20	83	0.40	0.10	125	0.25	0.00	167	0.15	0.10	209	0.30	0.15
42	0.10	0.10	84	0.00	0.25	126	0.30	0.20	168	0.20	0.05			

Appendix 9a: Decreasing Mean Side Clearance (mm) of Stellite-Tipped Saw K & L

K				L			
X-out	SD-out	X-in	SD-in	X-out	SD-out	X-in	SD-in
1.26	0.0868	1.16	0.0703	1.24	0.1231	1.12	0.1576
1.28	0.0760	1.11	0.0798	1.12	0.1133	1.05	0.1549
1.24	0.0902	1.05	0.0866	0.85	0.1309	0.76	0.1564
1.19	0.0945	0.84	0.3562	0.78	0.1241	0.65	0.1409
0.71	0.3324	0.69	0.1765	0.65	0.1498	0.50	0.1694
0.59	0.1723	0.55	0.1680	0.64	0.1668	0.46	0.1827
0.42	0.1441	0.39	0.1397	0.59	0.1893	0.41	0.1829
0.27	0.1201	0.22	0.1140	0.45	0.1643	0.30	0.1680
0.15	0.0908	0.10	0.1038	0.31	0.1467	0.17	0.1389

Legend :X-out= Mean side clearance of outer part of saw
X-in= Mean side clearance of inner part of saw

Appendix 9b: Decreasing Mean Side Clearance (mm) of Stellite-Tipped Saw M & N

M				N			
X-out	SD-out	X-in	SD-in	X-out	SD-out	X-in	SD-in
1.26	0.1620	1.14	0.1373	1.43	1.1168	1.32	0.1300
1.24	0.1877	1.08	0.1693	1.39	1.3836	1.26	0.1476
1.22	0.1895	0.99	0.1750	1.25	0.1566	1.19	0.1616
1.07	0.1885	0.84	0.1883	1.10	0.2462	1.05	0.2038
1.00	0.1747	0.80	0.1857	0.81	0.2523	0.78	0.2859
0.95	0.1669	0.71	0.1817	0.64	0.2358	0.64	0.2591
0.73	0.1825	0.39	0.1800	0.44	0.2080	0.43	0.2130
0.66	0.2236	0.29	0.1849	0.23	0.1561	0.21	0.1636
0.48	0.1901	0.14	0.1403	0.15	0.1207	0.13	0.1145

Legend :X-out= Mean side clearance of outer part of saw
X-in= Mean side clearance of inner part of saw

Appendix 10a: Side Clearance and Thickness of Boards (Stellite K)

Side Clearance	Board Thickness (mm)									
(mm)	1	2	3	4	5	6	7	8	9	10
1.2105	41.84	42.03	42.40	42.84	41.77	41.97	42.43	42.79	42.30	42.46
1.1987	42.65	41.71	42.04	42.26	41.57	42.62	41.92	42.37	42.38	42.14
1.1439	42.16	42.40	42.31	42.15	41.54	42.77	42.34	42.48	42.39	42.13
1.0104	41.50	42.51	42.59	40.03	41.70	42.17	42.53	42.69	42.08	42.10
0.6966	41.76	42.80	42.29	42.58	41.42	41.36	42.18	41.93	42.39	42.06
0.5689	43.96	44.03	43.93	43.25	43.58	44.89	43.44	44.77	43.18	42.69
0.4035	41.90	42.04	41.95	41.28	41.98	41.96	42.21	41.68	42.75	42.63
0.2481	42.06	42.48	42.07	41.55	42.04	41.98	42.08	42.37	43.07	42.97
0.1275	42.43	42.23	42.14	42.17	41.93	42.02	43.74	42.23	41.94	42.17

Note : Side Clearance=(Xout + Xin) / 2

Appendix 10b: Side Clearance and Standard Deviation of Thickness of Sawn Boards (Stellite K)

Side Clearance	Standard Deviation of Thickness of Sawn Boards									
(mm)	1	2	3	4	5	6	7	8	9	10
1.2105	1.0139	1.3590	1.6094	1.7743	1.4584	1.2873	1.6216	1.9402	1.4950	1.5793
1.1987	0.9321	1.4834	1.2255	0.8257	1.6096	0.9757	1.1697	1.3568	1.3425	1.3427
1.1439	1.2542	1.2826	0.9031	0.9028	1.3704	1.2138	1.0790	1.4911	1.3580	1.4101
1.0104	0.6124	1.4943	0.8525	1.1935	1.1683	0.7362	1.1694	1.2842	1.2398	1.0277
0.6966	0.1673	0.2092	0.4561	0.2050	0.7855	0.2608	0.2885	0.3916	0.1884	0.1684
0.5689	0.2924	0.2361	0.2885	0.1275	0.3271	0.3748	0.1981	0.3493	0.2885	0.2247
0.4035	0.2784	0.1673	0.1904	0.1643	0.3269	0.3860	0.3517	0.4125	0.7861	0.3046
0.2481	1.2477	1.3089	0.9576	0.9657	1.1123	1.6049	1.4106	0.8392	1.3834	0.7956
0.1275	1.6442	1.6817	1.4028	1.3046	1.3755	1.2337	0.8444	1.0906	1.9198	0.9445

Note :Side Clearance=(Xout +Xin) / 2

Appendix 11a: Side Clearance and Thickness of Boards (Stellite L)

Side Clearance	Board Thickness (mm)									
(mm)	1	2	3	4	5	6	7	8	9	10
1.1798	41.88	44.12	43.31	43.10	43.37	43.08	42.89	43.19	42.56	42.24
1.0872	43.10	43.59	43.69	42.90	43.37	42.89	42.14	42.24	42.35	43.39
0.8025	42.52	42.22	42.01	42.16	42.55	42.09	41.85	41.68	42.38	42.39
0.7142	42.55	42.05	42.43	41.57	41.99	41.96	42.06	42.10	41.84	42.45
0.5720	43.00	43.81	42.8	43.08	43.81	43.18	42.16	42.80	42.73	42.06
0.5514	42.85	42.54	42.87	42.39	42.95	41.63	41.83	41.08	41.75	41.93
0.4996	42.59	42.46	42.12	42.01	42.44	41.96	41.32	42.83	42.87	41.40
0.3718	43.00	42.14	42.04	41.91	42.89	42.54	42.34	42.81	42.70	42.00
0.2424	40.59	40.31	40.77	40.53	39.14	39.00	39.16	40.42	40.88	39.14

Note :Side Clearance=(Xout + Xin) / 2

Appendix 11b: Side Clearance and Standard Deviation of Thickness of Sawn Boards (Stellite L)

Side Clearance	Standard Deviation of Thickness of Sawn Boards									
(mm)	1	2	3	4	5	6	7	8	9	10
1.1798	2.1939	2.5255	0.9310	0.8595	1.1444	1.0165	1.9914	1.1163	1.5221	1.4515
1.0872	1.6198	1.5536	0.6086	1.2565	1.3454	1.1621	1.6502	0.9877	1.2080	1.6641
0.8025	0.8765	0.7604	0.5818	1.0526	1.1500	1.0703	1.2329	1.1367	1.2868	1.3310
0.7142	0.3446	0.2784	0.1396	0.3233	0.3286	0.3362	0.3489	0.3082	0.1557	0.2151
0.5720	0.4743	0.2966	0.3899	0.4207	0.1432	0.2408	0.1746	0.2872	0.3054	0.3782
0.5514	0.2180	0.0962	0.3818	0.4891	0.1732	0.3801	0.2907	0.1643	0.4123	0.3701
0.4996	0.3814	0.2535	0.2515	0.2302	0.1949	0.4393	0.4102	0.3899	0.4177	0.5116
0.3718	1.1750	1.0923	1.5405	1.0668	1.2049	1.3520	0.8518	0.9337	0.5880	1.0392
0.2424	1.5773	0.9607	1.1628	1.5259	0.6832	1.2575	1.4258	1.5647	1.1676	1.3428

Note : Side clearance=(Xout + Xin) / 2

Appendix 12a: Side Clearance and Thickness of Boards (Stellite M)

Side Clearance	Board Thickness (mm)									
(mm)	1	2	3	4	5	6	7	8	9	10
1.2009	39.14	38.64	38.38	38.58	38.68	38.72	40.29	40.27	39.42	39.04
1.1590	42.09	42.38	41.32	42.38	42.17	41.80	42.11	41.90	41.76	41.90
1.1007	41.92	41.25	41.60	40.38	40.70	40.33	41.32	41.72	42.19	42.43
0.9513	41.43	41.69	41.76	41.94	41.52	41.77	40.74	41.62	42.06	41.89
0.8996	42.21	41.89	42.31	42.41	42.25	42.19	42.62	41.98	42.08	42.29
0.8319	42.29	42.25	41.99	42.52	42.02	41.94	42.22	42.53	42.48	42.24
0.5576	41.99	42.35	42.28	42.17	42.08	42.04	41.37	42.10	42.44	42.07
0.4723	42.45	42.35	42.51	42.24	42.03	42.07	42.17	42.19	42.22	42.07
0.3108	42.51	42.02	42.00	42.03	40.82	42.94	41.66	42.23	42.43	41.31

Note : Side Clearance=(Xout + Xin) / 2

Appendix 12b: Side Clearance and Standard Deviation of Thickness of Sawn Boards (Stellite M)

Side Clearance	Standard Deviation of Thickness of Sawn Boards									
mm	1	2	3	4	5	6	7	8	9	10
1.2009	0.6832	1.6761	1.7870	1.2138	1.4363	1.7046	1.8989	1.2398	1.3790	1.5853
1.1590	0.6368	1.5959	1.2930	1.4394	0.9445	0.9843	1.4446	1.0025	1.2973	1.2840
1.1007	1.7196	0.9474	0.6354	0.7694	0.7045	1.2969	1.3832	1.1060	1.0755	1.0238
0.9513	1.1660	0.8562	0.4709	1.2754	0.9827	0.5143	1.3169	1.0663	1.1653	1.2306
0.8996	0.6850	0.9476	1.0668	0.4942	0.8103	0.7725	1.5990	1.0318	0.7120	1.1183
0.8319	0.2881	0.3000	0.4006	0.2139	0.2335	0.4114	0.3768	0.2465	0.2752	0.3399
0.5576	0.3507	0.3953	0.2414	0.3384	0.2485	0.3305	0.3013	0.2958	0.3701	0.4117
0.4723	0.3446	0.2828	0.1597	0.3343	0.2820	0.4117	0.3328	0.4547	0.3054	0.3511
0.3108	1.3381	1.3904	1.3574	1.3841	1.2760	0.9679	0.9522	1.1228	1.5304	1.8663

Note : Side Clearance=(Xout + Xin) / 2

Appendix 13a: Side Clearance and Thickness of Boards (Stellite N)

Side Clearance	Board Thickness (mm)									
(mm)	1	2	3	4	5	6	7	8	9	10
1.3710	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
1.3242	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
1.2188	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
1.0706	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
0.7937	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
0.6424	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
0.4336	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
0.2228	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64
0.1389	42.11	41.84	42.23	44.04	42.40	43.74	42.14	42.44	41.68	41.64

Note : Side Clearance=(Xout + Xin) / 2

Appendix 13b: Side Clearance and Standard Deviation of Thickness of Sawn Boards (Stellite N)

Side Clearance	Standard Deviation of Thickness of Sawn Boards									
(mm)	1	2	3	4	5	6	7	8	9	10
1.3710	1.3685	1.0139	1.0906	0.7326	1.6094	0.8444	0.6832	1.5884	1.8807	1.6761
1.3242	1.4167	1.4412	0.9627	1.0559	1.3755	1.0550	1.2312	0.9654	1.0456	1.0183
1.2188	1.4068	1.3046	1.0610	1.2230	0.6079	0.8598	1.3460	1.7413	0.6648	1.0630
1.0706	1.2179	1.2337	0.3248	0.5740	1.0371	1.8246	1.6094	1.0139	0.9072	1.2873
0.7937	0.3847	0.5920	0.3564	0.1581	0.3209	0.2408	0.6006	0.3271	0.4472	0.3581
0.6424	0.3229	0.1924	0.2924	0.5473	0.3613	0.3248	0.2770	0.3000	0.4472	0.6001
0.4336	0.3317	0.3831	0.3111	0.3328	0.3493	0.1223	0.1917	0.2465	0.3748	0.3565
0.2228	1.5353	1.1258	1.2111	0.9935	1.2194	1.3731	0.8700	1.1878	1.2206	1.1654
0.1389	1.2602	2.4051	1.3141	1.2738	1.5490	1.2543	1.8560	1.2629	1.6230	1.0139

Note : Side Clearance=(Xout + Xin) / 2

Appendix 14: Depth of Cut and Thickness of Sawn Lumber

Depth of Cut(cm)	Average Thickness of Sawn Lumber (mm)									
	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
80	42.24	43.06	41.88	44.12	43.31	43.10	42.40	42.89	42.18	42.70
75	39.14	38.64	38.38	38.58	38.68	39.44	39.61	40.10	39.37	39.08
61	42.73	41.68	41.38	41.87	41.83	41.75	42.27	41.77	41.72	42.21
50	42.04	42.92	42.13	42.27	42.40	42.31	42.08	42.03	43.08	42.91
42	42.33	42.21	42.09	42.57	42.09	42.65	42.91	42.74	43.08	42.04
32	42.97	42.64	42.61	43.21	43.21	42.77	42.76	42.34	42.46	42.61

Legend: X=Average thickness of sawn lumber

Appendix 15: Thicknesses of Boards Sampled

Sample Number	Number of Boards Sampled	Mean Thickness (mm)
1	6	43.39
2	6	38.86
3	6	44.15
4	6	42.16
5	6	43.17
6	6	42.50
7	6	42.46
8	6	42.27
9	6	44.43
10	6	42.25
11	6	42.30
12	6	42.95
13	6	44.20
14	6	41.78
15	6	42.64
16	6	41.18
17	6	42.60
18	6	41.68
19	6	42.49
20	6	42.71
21	6	42.59
22	6	42.94
23	6	42.50
24	6	42.20
25	6	42.57
26	6	42.74
27	6	42.74
28	6	42.37
29	6	41.90
30	6	40.98
31	6	41.35
32	6	41.68
33	6	42.24
34	6	44.15
35	6	41.99
36	6	41.77
37	6	44.26
38	6	42.05
39	6	42.17
40	6	41.41